

**Missouri Department of Natural Resources
Water Protection Program
Water Pollution Control Branch
Engineering Section**

Water Quality and Antidegradation Review

For the Protection of Water Quality
and Determination of Effluent Limits for Discharge to

Tributary to Peruque Creek

By

AMERICAN FOODS DEVELOPMENT CO., LLC



March 2023

Table of Contents

1.	PURPOSE OF ANTIDEGRADATION REVIEW REPORT	3
2.	FACILITY INFORMATION	3
3.	FACILITY HISTORY	4
	A. RECEIVING WATERBODY INFORMATION	4
	B. EXISTING WATER QUALITY	4
	C. MIXING CONSIDERATIONS	5
4.	PERMIT LIMITS AND MONITORING INFORMATION	5
5.	RECEIVING WATER MONITORING REQUIREMENTS	6
6.	ANTIDEGRADATION REVIEW INFORMATION	6
	A. TIER DETERMINATION	6
	B. NECESSITY OF DEGRADATION.....	7
	i. Regionalization	7
	ii. No Discharge Evaluation	8
	iii. Alternatives to No discharge	8
	iv. Preferred Alternative	9
	C. LOSING STREAM ALTERATIVE DISCHARGE LOCATION	10
	D. SOCIAL AND ECONOMIC IMPORTANCE	10
	E. NATURAL HERITAGE REVIEW	11
	F. ASSIMILATIVE CAPACITY CALCULATIONS	11
	G. DEMONSTRATION OF INSIGNIFICANCE	11
7.	DERIVATION AND DISCUSSION OF PARAMETERS AND LIMITS	11
8.	GENERAL ASSUMPTIONS OF THE WATER QUALITY AND ANTIDEGRADATION REVIEW	15
9.	ANTIDEGRADATION REVIEW PRELIMINARY DETERMINATION	15
	Appendix A: Map of Discharge Location.....	17
	Appendix B: Geohydrologic Evaluation.....	18
	Appendix C: Antidegradation Review Summary Attachments	24
	Appendix D: Natural Heritage Review.....	31
	Appendix E: Recommended Effluent Limits for the Proposed New 3.5 Million Gallon per Day Wright City South Wastewater Treatment Facility	39

1. PURPOSE OF ANTIDEGRADATION REVIEW REPORT

This is a new facility to accommodate flows from the new American Foods Group (AFG) beef processing facility. AFG is proposing to process 2,400 cows per day which contributes 1.5 MGD of the proposed 3.5 MGD. The long-term plan is to incorporate flows from the Wright City South Wastewater Treatment Facility and provide additional treatment capabilities for community growth while accommodating water quality goals. This Water Quality and Antidegradation Review applies to AFG and additional Domestic Wastewater flow currently permitted under the Wright City Wastewater Treatment Facility permit MO0023191.

Woodard & Curran, Inc. prepared on behalf of AFG the Antidegradation Application for the Wright City Wastewater Treatment Facility. The applicant elected to assume that all pollutants of concern (POC) significantly degrade the receiving stream in the absence of existing water quality. An alternatives analysis was conducted to fulfill the requirements of the Antidegradation Implementation Procedure (AIP).

The preferred alternative is presented as the Less Degrading Alternative #1, a 4-Stage Bardenpho Conventional Activated Sludge (CAS) facility with sidestream biological total phosphorus removal, and UV disinfection. The facility is being designed for a Design Flow of 3.5 million gallons per day (MGD) that accommodates 1.5 MGD for the new AFG facility and possible future connection of 0.5 MGD from the existing users in Wright City, and 1.5 MGD for future expansion in the community. The preferred alternative will include a new influent lift station, headworks, grit removal, biological treatment tanks (4-Stage Bardenpho), final clarifiers, tertiary filtration, UV disinfection, reaeration system, a new outfall, new aerobic sludge storage tanks and mechanical sludge dewatering with offsite cake disposal.

2. FACILITY INFORMATION

Facility Name:	American Foods Group Wastewater Treatment Facility
Address:	100 Lagoon Road, Wright City, MO 63390
Permit #:	
County:	Warren County
Facility Type:	Industrial
Owner:	AMERICAN FOODS DEVELOPMENT CO., LLC
Continuing Authority:	AMERICAN FOODS DEVELOPMENT CO., LLC – FL001693465
UTM Coordinates:	X = 673191 ; Y = 4298507
Legal Description:	Sec 22, T47N, R01W
Ecological Drainage Unit:	Central Plains/Cuivre/Salt

3. FACILITY HISTORY

This is a new facility.

A. RECEIVING WATERBODY INFORMATION

OUTFALL(S) TABLE:

OUTFALL	DESIGN FLOW (CFS)	TREATMENT LEVEL	EFFLUENT TYPE
001	5.425	Secondary	Domestic

RECEIVING STREAM(S) TABLE:

WATER-BODY NAME	CLASS	WBID	DESIGNATED USES*	12-DIGIT HUC	DISTANCE TO CLASSIFIED SEGMENT (MI)
Tributary to Peruque Creek	NA	NA	General Criteria	07110009-0101	0.17
Presumed Use Stream	C	5025	AQL-WWH, WBC-B, SCR, HHP, IRR, LWW		
Peruque Creek – 303(d)	C	218	AQL-WWH, WBC-B, SCR, HHP, IRR, LWW		0.76

* Protection of Warm Water Aquatic Life (AQL), Cold Water Fishery (CDF), Cool Water Fishery (CLF), Whole Body Contact Recreation – Category A (WBC-A), Whole Body Contact Recreation – Category B (WBC-B), Secondary Contact Recreation (SCR), Human Health Protection (HHP), Irrigation (IRR), Livestock & Wildlife Watering (LWW), Drinking Water Supply (DWS), Industrial (IND), Groundwater (GRW).

RECEIVING STREAM(S) LOW-FLOW VALUES:

RECEIVING STREAM	LOW-FLOW VALUES (CFS)		
	1Q10	7Q10	30Q10
Tributary to Peruque Creek	0.0	0.0	0.0

Receiving Water Body Segment Outfall #001:		
Upper end segment* UTM coordinates:	X = 673191 ; Y = 4298507	outfall
Lower end segment* UTM coordinates:	X = 673179 ; Y = 4298254	downstream confluence

*Segment is the portion of the stream where discharge occurs. Segment is used to track changes in assimilative capacity and is bound at a minimum by existing sources and confluences with other significant water bodies.

A Geohydrologic Evaluation was submitted with the *Antidegradation Application*, and the receiving stream is considered gaining for discharge purposes. In the event of wastewater treatment failure, shallow groundwater and surface waters of Peruque Creek and its tributaries may be adversely impacted. The mechanical treatment plant site received a slight geologic limitations rating overall. The existing lagoons received a moderate geologic limitations rating primarily due to the lagoons' placement on an alluvial plain, and received a slight collapse potential rating. (see Appendix B)

B. EXISTING WATER QUALITY

No existing water quality data was submitted in the Antidegradation Report. The facility discharges to Peruque Creek, which flows to Lake St. Louis. Peruque Creek is on the 2020 303(d) list for low dissolved oxygen (DO) and low

aquatic macroinvertebrate diversity. Lake St Louis is on the 2020 303(d) list for Chlorophyll-a. The Total Maximum Daily Load (TMDL) and Modeling Unit was consulted to support effluent limit development for the proposed expansion discussed in this WQAR and *Antidegradation Application*. A complete discussion can be found in Appendix E and in Section 6.

C. MIXING CONSIDERATIONS

Mixing Zone: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)].

Zone of Initial Dilution: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

4. PERMIT LIMITS AND MONITORING INFORMATION

Table 1: Proposed Monitoring Parameters and Effluent Limits for the American Foods Group WWTF at a Design Flow of 3.5 MGD

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average
Flow	MGD	1	*		*
BOD ₅	mg/L	6		9	6
TSS	mg/L	6		15	10
<i>Escherichia coli</i> **	CFU/100mL	1, 3	1,030		206**
Fecal Coliform	CFU/100mL	1	400		400
Ammonia as N					
Winter	mg/L	6	7.5		2.9
Summer	mg/L		3.6		1.4
Oil & Grease	mg/L	1, 3	15		10
Total Phosphorus, Note 1	mg/L lbs/year	6, 12	*		1.0
Total Nitrogen	mg/L	6	*		11.0
Total Kjeldahl Nitrogen	mg/L	6	*		*
Nitrite + Nitrate	mg/L	6	*		10.0
PARAMETER	Unit	Basis for Limits	Minimum		Maximum
pH	SU	3	6.5		9.0
PARAMETER	Unit	Basis for Limits	Daily Minimum		Monthly Avg. Min
Dissolved Oxygen (DO)	mg/L	6	7		7

* - Monitoring requirement only

** - #/100mL; the Monthly Average for *E. coli* is a geometric mean.

Note 1: Total Phosphorus effluent limits are water quality based effluent limits established based on the March 8, 2022 memorandum (Appendix E), describing the Recommended Effluent Limits for the Proposed New 3.5 Million Gallons per Day Wastewater Treatment Facility. Compliance with the total phosphorus effluent limits established by the final operating permit for the facility may include monthly average concentration (mg/L), average load in pounds per month, or average load in pounds per year.

Basis for Limitations Codes:

- | | | |
|--|---------------------------|----------------------------------|
| 1. State or Federal Regulation/Law | 5. Antidegradation Policy | 9. WET Test Policy |
| 2. Water Quality Standard (includes RPA) | 6. Water Quality Model | 10. Multiple Discharger Variance |

3. Water Quality Based Effluent Limits

7. Best Professional Judgment

11. Nutrient Criteria Implementation Plan

4. Antidegradation Review

8. TMDL or Permit in lieu of TMDL

12. Total Phosphorus Rule

Table 2: Permitted Feature INF- Influent Monitoring for the American Foods Group WWTF at a Design Flow 3.5 MGD

PARAMETER	Unit	Basis for Limit	Daily Maximum	Weekly Average	Monthly Average
BOD ₅	mg/L	1			*
TSS	mg/L	1			*
Ammonia as N	mg/L	1	*		*
Total Phosphorus	mg/L	1	*		*
Total Kjeldahl Nitrogen	mg/L	1	*		*
Nitrite + Nitrate	mg/L	1	*		*

Basis for Limitations Codes:

* Monitoring Requirement Only

1. State or Federal Regulation/Law

5. RECEIVING WATER MONITORING REQUIREMENTS

No receiving water monitoring requirements are recommended at this time.

6. ANTIDegradation REVIEW INFORMATION

In accordance with Missouri's Water Quality Standard [10 CSR 20-7.031(3)] and federal antidegradation policy at Title 40 Code of Federal Regulation (CFR) Section 131.12 (a), the department developed a statewide antidegradation policy and corresponding procedures to implement the policy. A proposed discharge to a water body will be required to undergo a level of Antidegradation Review, which documents that the use of a water body's available assimilative capacity is justified. Effective August 30, 2008, and revised July 13, 2016, a facility is required to use Missouri's AIP for new and expanded wastewater discharges.

The AIP specifies that if the proposed activity results in significant degradation then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required.

The following is a review of the *Antidegradation Application* dated April 8, 2022.

A. TIER DETERMINATION

Waterbodies are assigned Tier 1, 2, or 3 protection levels.

Tier 1 protection is applied to a waterbody on a pollutant by pollutant basis for pollutants may cause or contribute to the impairment of a beneficial use or violation of Water Quality Criteria (WQC); and prohibit further degradation of Existing Water Quality (EWQ) where additional pollutants of concern (POCs) would result in the water being included on the 303(d) List.

Tier 2 level protection is assigned to the waterbody on a pollutant by pollutant basis that prohibits the degradation of water quality of a surface water unless a review of reasonable alternatives and social and economic considerations justifies the degradation in accordance with the methods presented in the AIP.

Tier 3 protection prohibits any degradation of water quality of Outstanding National Resource Waters and Outstanding State Resource Waters as identified in Tables D and E of the Water Quality Standards (WQS). Temporary degradation of water receiving Tier 3 protection may be allowed by the Department on a case-by-case basis as explained in Section VI of the AIP.

Below is a list of POCs reasonably expected and identified by the permittee in their application to be in the discharge. Pollutants of concern are defined as those pollutants "proposed for discharge that affect beneficial use(s) in waters of the state." They include pollutants that "create conditions unfavorable to beneficial uses in the water body receiving

the discharge or proposed to receive the discharge” (AIP, Page 6).

All of the pollutants of concern are considered significantly degrading for the purpose of this review. BOD₅ and DO are considered Tier I in this review due to the receiving stream’s status on the 303(d) list.

Table 3: Pollutants of Concern and Tier Determination

Pollutants of Concern	Tier	Degradation	Comment
Biological Oxygen Demand (BOD ₅)/DO	1	Significant	See Appendix E
Total Suspended Solids (TSS)	**	Significant	
Ammonia as N	2*	Significant	
<i>Escherichia coli</i> (<i>E. coli</i>)	2*	Significant	Permit Limits Apply
Fecal Coliform	2*	Significant	Permit Limits Apply
Oil & Grease	2*	Significant	Permit Limits Apply
Phosphorus, Total	1	Significant	
Nitrogen, Total	1	Significant	
Total Kjeldahl Nitrogen	1	Significant	
Nitrite + Nitrate	1	Significant	
pH	***	Significant	Permit Limits Apply

* Tier assumed.

** Tier determination not possible: No in-stream standards for these parameters.

*** Standards for these parameters are ranges.

Tier 1 Review

The facility discharges to Peruque Creek which flows into Lake St. Louis. Peruque Creek is on the 2020 303(d) list for low DO and low aquatic macroinvertebrate diversity. Lake St Louis is on the 2020 303(d) list for Chlorophyll-a. The Total Maximum Daily Load and Modeling Unit (TMDL Unit) was consulted to support effluent limit development for the proposed project discussed in this WQAR and *Antidegradation Application*. The results of the TMDL Unit’s assessment are included in *Appendix E: Recommended Effluent Limits for the Proposed New 3.5 MGD Wright City South Wastewater Treatment Facility*.

The TMDL Unit estimated the influence of the expanded 3.5 MGD industrial and domestic wastewater treatment facility on water quality in Peruque Creek and Lake St Louis. This analysis was completed to recommend effluent limits that should minimize the potential for the new facility to cause or contribute to the low dissolved oxygen impairment in Peruque Creek and exceedances of Missouri’s lake numeric criteria in Lake St. Louis. The recommended effluent limits are based on a combination of QUAL2K modeling to address low dissolved oxygen in Peruque Creek and BATHTUB modeling to address lake numeric nutrient criteria in Lake St. Louis. Recommended effluent limits are discussed in Section 7, Table 1, and Appendix E.

According to the AIP, the waters may receive the POCs that are causing impairments if; 1) the discharge would not cause or contribute to a violation of the WQS; 2) all other conditions of the state permitting requirements are met (i.e., no discharge options are explored and technology based requirements (including ELGs) are met); and 3) the permit is issued with the highest statutory and regulatory requirements.

B. NECESSITY OF DEGRADATION

The AIP specifies that if the proposed activity does result in significant degradation then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required. Part of that analysis as shown below is the evaluation of non-degrading alternatives, such as regionalization or no discharge systems.

i. Regionalization

The regionalization alternative was described in No Discharge Alternative #4 – Diversion of Flow to Another District WWTF. A discussion of this alternative is provided in Section 6.B.ii.

ii. No Discharge Evaluation

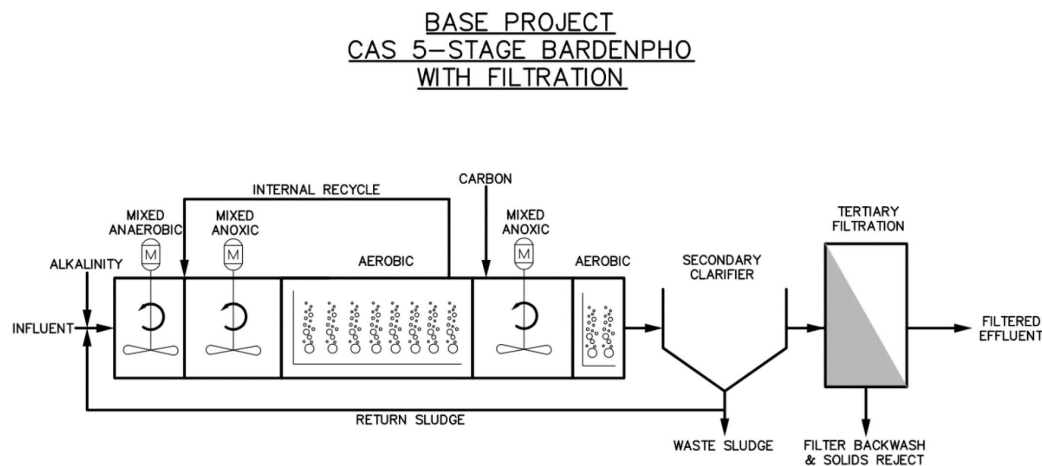
A total of six no discharge alternatives were included in the *Antidegradation Application*. All no discharge evaluations were described as impractical.

- Land Application with Seasonal Storage: Impractical – There are no agricultural tracks of land near the site to utilize this option.
- Subsurface Disposal with Seasonal Storage: Impractical – The subsurface disposal alternative has similar system encumbrances as land application with seasonal storage. A large amount of land would be needed for this alternative and would create a substantial burden. The subsurface alternative would also require additional land disturbance for construction and maintenance for long-term operation.
- Recycling or Reuse: Impractical – Potential end users for recycle or reuse are golf courses, truck washing, groundwater recharge, and non-potable process water. Since the proposed flow rate is 3.5 MGD, no end users would be able to reuse this quantity on non-potable water.
- Diversion of Flow to Another District WWTF: Impractical – Wright City South WWTF is established as a regional facility and POTW. A previous study was conducted by the district to evaluate the feasibility of transferring flow from Wright City South WWTF to the District's Hickory Trails WWTF or Providence Estates WWTF. For the Providence Estates diversion, there is insufficient land available for facility upgrades due to planned residential developments in the vicinity. For the Hickory Trails diversion, the high cost associated with facility upgrades and flow conveyance make this option impractical.
- Alternative Discharge Location: Impractical – Peruque Creek is one of the only sizable potential receiving waters in the vicinity. An effluent lift station and force main to McCoy Creek was also considered as an alternative receiving water. The length of pipe, energy requirements, and costs to pump additional effluent to McCoy Creek is cost prohibitive.
- Improved Operations & Maintenance at Wright City South WWTF: Impractical – This option is impractical since the current lagoon system is currently operating at capacity and there is a bona fide need to increase the design flow, increase nutrient reduction capabilities, and resolve potential effluent limit exceedances.

iii. Alternatives to No discharge

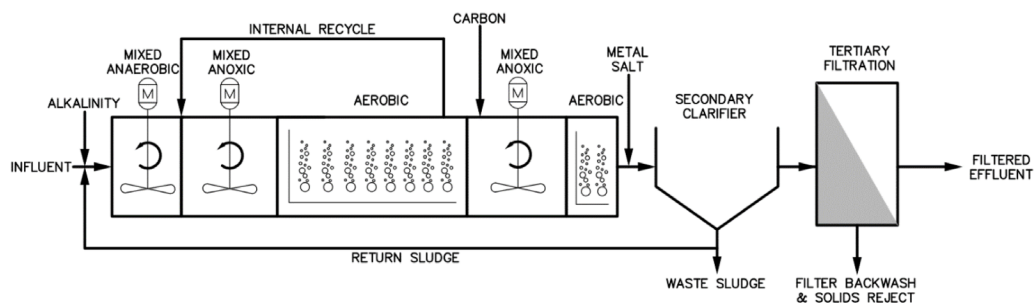
A total of 3 less degrading alternatives were evaluated in the *Antidegradation Application*. All three alternatives were determined to be practical. An alternatives analysis comparison is included as Table 4.

Base Project – 5 Stage Bardenpho CAS with Filtration: This is a conventional activated sludge (CAS) system with provisions for Biological Nutrient Reduction in a 5 stage Bardenpho type configuration with suspended growth treatment processes. Tanks in series with separate zones are utilized for the treatment of BOD, ammonia, TN, and TP. The treatment capability for this alternative is presented in Table 4.



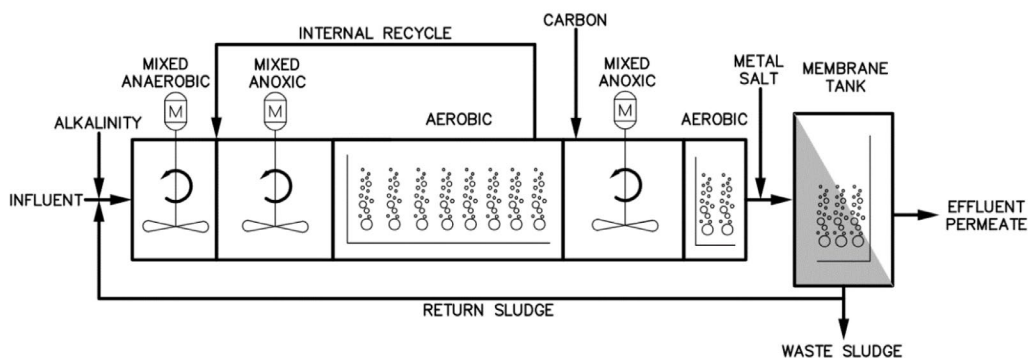
Alternative 1 – 5 Stage Bardenpho CAS with Filtration and Chemical Addition: This alternative adds additional chemical coagulation treatment processes to the Base Project to treat for a higher quality effluent. This alternative will include additional chemical feed systems and chemical storage systems compared to the Base Project. The treatment capability for this alternative is presented in Table 4.

LESS-DEGRADING ALTERNATIVE #1
CAS 5-STAGE BARDENPHO
WITH FILTRATION & CHEMICAL ADDITION



Alternative 2 – Membrane Bioreactor (MBR): An MBR treatment facility was evaluated as a comparison to the Base Project Bardenpho CAS options. As part of this alternative the biological reactors upstream of the membrane filters would be configured as a 5-Stage Bardenpho process to allow for TN, TP and Ammonia biological removal.

LESS-DEGRADING ALTERNATIVE #2
MEMBRANE BIOREACTOR



iv. Preferred Alternative

The preferred alternative is identified as Alternative #1 (5-Stage Bardenpho CAS with Filtration and Chemical Addition) due to the lower up front capital cost, favorable cost of ownership, favorable facility layout, expansion capabilities, provisions for biological phosphorus removal, provisions for total nitrogen removal, flow flexibility, and constructability.

Table 4: Discharging Alternatives Analysis Comparison

Parameter	Base Project CAS 5 Stage Bardenpho with Filtration	Alternative 1 CAS 5 Stage Bardenpho with Filtration & Chemical Addition	Alternative 2 Membrane Bioreactor 5 Stage Bardenpho & Chemical Addition
BOD ₅	≤ 10 mg/L	≤ 5-10 mg/L	≤ 5 mg/L
TSS	≤ 10 mg/L	≤ 5-10 mg/L	≤ 1 mg/L
DO	> 6 mg/L	> 6 mg/L	> 6 mg/L
Ammonia as N	≤ 1 mg/L	≤ 1 mg/L	≤ 1 mg/L
Oil & Grease	< 10 mg/L	< 10 mg/L	< 7 mg/L
pH	6.5-9.0	6.5-9.0	6.5-9.0
<i>Escherichia coli</i> (<i>E. coli</i>)	≤ 206 CFU/100mL	≤ 206 CFU/100mL	≤ 206 CFU/100mL
Phosphorus, Total	≤ 1 mg/L	≤ 1 mg/L	≤ 0.1 mg/L
Nitrogen, Total	< 5-10 mg/L	< 5-10 mg/L	< 3-5 mg/L
Practicability	Yes	Yes	Yes
Preferred	No	Yes	No
Total Initial Capital Cost	\$98,500,000	\$98,600,000	\$127,600,000
Present Value of O&M Costs	\$39,320,000	\$43,373,000	\$49,121,000
Total Present Worth*	\$137,820,000	\$141,973,000	\$176,721,000
Total Annual Costs	\$2,018,000	\$2,226,000	\$2,521,000
Base to Alternative Cost Ratio	1.0	1.03	1.3

*Life cycle cost at 20 year design life and 0.25% discount rate

C. LOSING STREAM ALTERNATIVE DISCHARGE LOCATION

Under 10 CSR 20-7.015(4) (A), discharges to losing stream shall be permitted only after other alternatives including land application, discharge to gaining stream and connection to a regional facility have been evaluated and determined to be unacceptable for environmental and/or economic reasons.

The American Foods Group WWTF outfall will discharge to Peruque Creek, classified as gaining for discharge purposes.

D. SOCIAL AND ECONOMIC IMPORTANCE

A thorough presentation of social and economic importance was included in the *Antidegradation Application*. The affected community is described as the Wright City and Warren County service area. A number of developments are planned for the immediate area around the facility; however, they are currently inhibited due to the lack of treatment capacity at the Wright City WWTF and unallocated treatment capacity of American Foods Group WWTF will be able to treat these developments. Specific social and economic factors are described as follows:

- Median Household Income: The Median Household Income is anticipated to rise as a result of the American Foods Group facility construction. The additional treatment capacity is expected to allow commercial development, additional job generation, and continued growth and development.
- Unemployment Rate: The American Foods Group facility construction is expected to bring a substantial quantity of jobs within the vicinity, directly reducing the unemployment rate. The additional unallocated treatment capacity of American Foods Group WWTF will also contribute to commercial expansion and further allow job creation in the service area.
- Poverty Level: Poverty Level is expected to decrease as a direct result of the reduced unemployment rate and increase in median household income created through the American Foods Group facility construction.

- **Commercial & Industrial Development Potential:** The proposed WWTF will allow commercial and industrial development to continue throughout the community. This will occur directly with the American Foods Group facility construction bringing more than 1,300 new jobs and generating \$1 billion in economic impact in Missouri. Additional treatment plant capacity will provide infrastructure for future commercial growth.
- **Public Services:** The goal of the proposed American Food Group facility is intended to accommodate new industrial, residential, and commercial wastewater flows and improve public services associated with wastewater treatment while protecting the surrounding environment in the community and safety of the WWTF operations staff.

E. NATURAL HERITAGE REVIEW

A Missouri Department of Conservation Natural Heritage Review was obtained by the applicant. Two species of bats, Indiana and Northern Long-Eared, may be present in the project area. The following recommendations were made for construction activities:

- During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy.
- Do not enter caves known to harbor Indiana Bats and/or Northern Long-eared Bats, especially from September to April.
- Manage construction to minimize sedimentation and run-off to nearby streams.
- At stream and drainage crossings, avoid erosion, silt introduction, petroleum or chemical pollution, and disruption or realignment of stream banks and beds.

F. ASSIMILATIVE CAPACITY CALCULATIONS

Since the *Antidegradation Application* presented all POCs as significantly degrading, assimilative capacity calculations were not completed to support a Minimally Degrading Review.

G. DEMONSTRATION OF INSIGNIFICANCE

The AIP states that a demonstration of insignificance of the discharge requires the applicant to show a reduction, or maintenance of loading, i.e., no change in ambient water quality concentrations in the receiving waters. Since the *Antidegradation Application* dated April 8, 2022 presented a significantly degrading review, a Demonstration of Insignificance is not necessary.

7. DERIVATION AND DISCUSSION OF PARAMETERS AND LIMITS

Wasteload allocations and limits were calculated using two methods:

A. Water quality-based – Using water quality criteria or water quality model results and the dilution equation below:

$$C = \frac{(C_s \times Q_s) + (C_e \times Q_e)}{(Q_e + Q_s)} \text{ (EPA/505/2-90-001, Section 4.5.5)}$$

Where

- C = downstream concentration
- C_s = upstream concentration
- Q_s = upstream flow
- C_e = effluent concentration
- Q_e = effluent flow

Chronic wasteload allocations were determined using applicable chronic water quality criteria (CCC: criteria continuous concentration) and stream volume of flow at the edge of the mixing zone (MZ). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration) and stream volume of flow at the edge of the zone of initial dilution (ZID).

Water quality-based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's "Technical Support Document For Water Quality-based Toxics Control" (EPA/505/2-90-001).

- B. Alternative Analysis-based** – Using the preferred alternative’s treatment capacity for conventional pollutants such as BOD₅ and TSS that are provided by the consultant as the WLA, the significantly-degrading effluent average monthly and average weekly limits are determined by applying the WLA as the average monthly (AML) and multiplying the AML by 1.5 to derive the average weekly limit (AWL).

Note: Significantly-degrading effluent limits have been based on the authority included in Section I.A. of the AIP. Also under 40 CFR 133.105, permitting authorities shall require more stringent limitations than equivalent to secondary treatment limitations for 1) existing facilities if the permitting authority determines that the 30-day average and 7-day average BOD₅ and TSS effluent values could be achievable through proper operation and maintenance of the treatment works, and 2) new facilities if the permitting authority determines that the 30-day average and 7-day average BOD₅ and TSS effluent values could be achievable through proper operation and maintenance of the treatment works, considering the design capability of the treatment process.

- C. Water Quality Model -based** – 303(d) listed waters are considered Tier 1 for the POCs attributed to use impairment. Prior to allowing any new or expanded discharges of the POC, the department must conduct a Tier 1 review and demonstrate that the discharge would not violate the water quality criteria for the POC. Tier 1 protection prohibits degradation that may cause or contribute to the impairment of a beneficial use or violation of water quality criteria and prohibits further degradation of existing water quality where additional pollutants of concern would result in the water being included on the 303(d) list. Using water quality model results, effluent limits and waste load allocations are developed to protect designated uses. These limits would be included in an Antidegradation review as Total Maximum Daily Load Limits or Water Quality Model Limits.

Outfall #001 – Main Facility Outfall

- **Flow.** Though not limited itself, the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations [40 CFR Part 122.44(i)(1)(ii)]. If the permittee is unable to obtain effluent flow, then it is the responsibility of the permittee to inform the department, which may require the submittal of an operating permit modification. Influent monitoring has been and will be required for this facility in its Missouri State Operating Permit.
- **Biochemical Oxygen Demand (BOD₅).** This WQAR establishes new Water Quality Model Limits of 6.0 mg/L as average monthly and 9.0 mg/L as average weekly. The March 8, 2022 memorandum (Appendix E) modeling results indicate that limiting BOD₅ discharges to no greater than a monthly average of 6.0 mg/L BOD₅ will promote the attainment of water quality standards in Peruque Creek. These limits are more stringent than the effluent limits of 81 mg/L daily maximum and 40 mg/L monthly average established in 40 CFR 432 Subpart B for Complex Slaughterhouses processing 2,400 cattle at 1000 lbs each generating 1.5 MGD flow.

Carbonaceous Biochemical Oxygen Demand Limits in Lieu of BOD₅ Limits

The recommended BOD₅ concentration is based on an Ultimate CBOD concentration entered into the QUAL2K model, which is then converted through CBOD₅ to BOD₅. The recommended BOD₅ concentration of 6 mg/L would have a corresponding CBOD₅ of 4.7 mg/L. If the wastewater treatment facility requests CBOD₅ limits instead of BOD₅, the CBOD₅ limit for the expanded facility would be 4.7 mg/L as average monthly and 7.1 mg/L as average weekly.

- **Dissolved Oxygen.** The new recommended Dissolved Oxygen (DO) effluent limits are 7.0 mg/L as Daily Minimum and Monthly Average Minimum. These Water Quality Model Limits were identified in the *Recommended Effluent Limits for the Proposed New 3.5 MGD Wright City South WWTF Memorandum (Appendix E)*. Since the facility will discharge to a DO-impaired segment of Peruque Creek, a QUAL2K model was used to estimate effluent limits that reduce the potential for wastewater discharges to cause or contribute to low DO in Peruque Creek.

Streeter Phelps (DO) Modeling was submitted by the applicant with the model inputs of 10 mg/L as monthly average BOD₅, effluent DO of 6 mg/L, summer temperature of 25.95 °C, and an effluent flow rate of 3.5 MGD.

The Streeter Phelps modeling results indicated that a minimum DO sag would occur at 2 days downstream and 5.1 mg/L DO. The applicant recommended a daily minimum DO effluent limit of 6 mg/L. The Department's recommended DO effluent limit will be utilized since it is more protective and has a greater margin of safety.

- **Total Suspended Solids (TSS)**. This WQAR establishes a limit of 15 mg/L as average weekly and 10 mg/L as a monthly average as Water Quality Model Limits. The March 8, 2022 memorandum (Appendix E) modeling results indicate limiting TSS discharges from the facility to no greater than a monthly average of 10 mg/L TSS will promote the attainment of water quality standards in Peruque Creek. These limits are more stringent than the effluent limits 48 mg/L daily maximum and 96 mg/L monthly average established in 40 CFR 432 Subpart B for Complex Slaughterhouses processing 2,400 cattle at 1000 lbs each generating 1.5 MGD flow.
- **Escherichia coli (E. coli)**. Monthly average effluent limit of 206 CFU per 100 mL as a geometric mean and daily maximum of 1,030 CFU per 100 mL as a geometric mean during the recreation season (April 1 – October 31) for dischargers within two miles upstream of segments or lakes with Whole Body Contact Recreation (B) designated use of the receiving stream, as per 10 CSR 20-7.015(9)(B). For all dischargers other than publicly owned treatment works, an effluent limit for both average monthly and maximum daily is required by 40 CFR 122.45(d)(1).
- **Fecal Coliform**. 40 CFR 432 Subpart A for Simple Slaughterhouses establishes new source performance standards/technology based maximum limit of 400 most probable number or colony forming units per 100 mL at any time.
- **Total Ammonia Nitrogen**. This WQAR establishes new effluent limits of 0.7 mg/L as average monthly and 2.2 mg/L as maximum daily. The March 8, 2022 memorandum (Appendix E) modeling results indicate that limiting Total Ammonia as Nitrogen discharges from the facility to no greater than a monthly average of 0.7 mg/L Total Ammonia as Nitrogen will promote the attainment of water quality. These limits are more stringent than the effluent limits 8 mg/L daily maximum and 4 mg/L monthly average established in 40 CFR 432 Subpart B for Complex Slaughterhouses.

US EPA Mussel Ammonia Criteria – Ammonia

The applicant supplied *Antidegradation Application* presented Total Ammonia as Nitrogen calculations based on the 2013 US EPA water quality criteria for Ammonia. The applicant provided these limits as proposed future limits for reference & planning purposes only. The applicant did not propose the US EPA Mussel Ammonia Criteria as Preferred Alternative Effluent Limits.

Table 6: US EPA Mussel Ammonia Criteria for the American Foods Group WWTF

Season	TAN MDL (mg/L)	TAN AML (mg/L)
Summer	1.7	0.6
Winter	5.6	2.1

Preferred Alternative Performance Level – Ammonia

The applicant proposed effluent limits for ammonia as nitrogen were calculated using the former method for calculating ammonia effluent limits. Default values of 0.6 as Cv and 7.8 SU as pH were used to generate the following preferred alternative effluent limits.

Table 7: Preferred Alternative Performance Level for Ammonia for the American Foods Group WWTF

Season	TAN MDL (mg/L)	TAN AML (mg/L)
Summer	3.6	1.4
Winter	7.5	2.9

- **Oil & Grease.** The water quality based effluent limits of 15 mg/L as daily maximum and 10 mg/L as monthly average will be implemented as a performance level. This is more stringent than 40 CFR 432 Subpart B for Complex Slaughterhouses new source performance standards/technology daily maximum limit of 31 mg/L and a monthly average limit of 15 mg/L for processing 2,400 cattle at 1000 lbs each generating 1.5 MGD flow.
- **Nutrient Limit.** The NPDES regulations at 40 CFR 122.45(d) require that all permit limits be expressed, unless impracticable, as both average monthly limits and maximum daily limits for all dischargers other than publicly owned treatment works (POTWs).

The applicant has requested Mass-based, annual limits for both TP and TN. Nutrient monitoring will be conducted on at least a weekly basis, and the monthly mass load will be summarized based on the total flow during the month and reported as a monthly load.

- **Total Phosphorus.** Monthly Average effluent limits of 1.0 mg/L at 3.5 MGD design flow of Total Phosphorus will be implemented as Water Quality Model Limits. The March 8, 2022 memorandum (Appendix E), describing the *Recommended Effluent Limits for the Proposed New 3.5 Million Gallons per Day Wright City South Wastewater Treatment Facility* has determined that phosphorus in effluent discharged from the facility has reasonable potential to cause or contribute to the Chl-a impairment of Lake St. Louis and the dissolved oxygen/low aquatic macroinvertebrate diversity impairments of Peruque Creek. Modeling results indicate that limiting Total Phosphorus discharges from the facility to no greater than a monthly average of 1.0 mg/L at 3.5 MGD Total Phosphorus will promote the attainment of water quality in Lake St. Louis and Peruque Creek. This translates to a maximum Total Phosphorus Annual Load, based on modeling results, of 10,654 lbs/year for TP.

$$8.34 \times 3.5 \text{ MG/day} \times 1.0 \text{ mg/l} \times 365 \text{ days/year} = 10,654 \text{ TP lbs/year}$$

- **Total Nitrogen.** Monthly Average effluent limits of 11.0 mg/L of Total Nitrogen will be implemented as a Water Quality Model Limit. The March 8, 2022 memorandum (Appendix E), describing the *Recommended Effluent Limits for the Proposed New 3.5 Million Gallons per Day Wright City South Wastewater Treatment Facility* has determined that nitrogen in effluent from the facility has reasonable potential to cause or contribute to the Chl-a impairment of Lake St. Louis and the dissolved oxygen/low aquatic macroinvertebrate diversity impairments of Peruque Creek. Modeling results indicate that limiting Total Nitrogen discharges from the facility to no greater than a monthly average of 11.0 mg/L Total Nitrogen will promote the attainment of water quality standards in Lake St. Louis and Peruque Creek. This translates to a maximum Total Nitrogen Annual Load, based on modeling results, of 117,198 lbs/year for TN. This is more stringent than 40 CFR 432 Subpart B for Complex Slaughterhouses new source performance standards/technology daily maximum limit of 134 mg/L and a monthly average limit of 134 mg/L for processing 2,400 cattle at 1000 lbs each generating 1.5 MGD flow.

$$8.34 \times 3.5 \text{ MG/day} \times 11 \text{ mg/l} \times 365 \text{ days/year} = 117,198 \text{ TN lbs/year}$$

- **Total Kjeldahl Nitrogen.** Per 10 CSR 20-7.015(9)(D)8.B. Statewide Monitoring for Nutrients. Point sources that have the design capacity of greater than one hundred thousand (100,000) gpd that typically discharge nitrogen and phosphorus shall collect and analyze influent and effluent samples for total phosphorus, ammonia, total kjeldahl nitrogen and nitrate plus nitrite utilizing methods outlined in 10 CSR 20-7.015(9)(D)2. using the following frequencies:

Monthly for facilities with design capacities greater than or equal to one million (1,000,000) gpd for a period up to five years. The department may require additional monitoring to ascertain a discharge's nutrient contribution and the efficacy of the treatment technology as it pertains to nutrient removal.

- **Nitrite + Nitrate.** Monthly Average effluent limits of 10.0 mg/L of Nitrite + Nitrate will be implemented as Water Quality Model Limits. The March 8, 2022 memorandum (Appendix E), describing the *Recommended Effluent Limits for the Proposed New 3.5 Million Gallons per Day Wright City South Wastewater Treatment*

Facility has determined that nitrogen in effluent from the facility has reasonable potential to cause or contribute to the Chl-a impairment of Lake St. Louis and the dissolved oxygen/low aquatic macroinvertebrate diversity impairments of Peruque Creek. Modeling results indicate that limiting Nitrite + Nitrate discharges from the facility to no greater than 10.0 mg/L Nitrite + Nitrate as a monthly average will promote the attainment of water quality in Lake St. Louis and Peruque Creek.

- **pH.** The preferred alternative selected for ammonia treatment serves as the base case for pH with effluent limit range of 6.5-9.0 SU. Technology based effluent limitations of 6.0-9.0 SU [10 CSR 20-7.015] are not protective of the Water Quality Standard, which states that water contaminants shall not cause pH to be outside the range of 6.5-9.0 SU. No mixing zone is allowed due to the classification of the receiving stream, therefore the water quality standard must be met at the outfall.

Permitted Feature INF – Influent Parameters

- **Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia.** Monthly influent monitoring for Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia is required per 10 CSR 20-7.015(9)(D)8.B.

8. GENERAL ASSUMPTIONS OF THE WATER QUALITY AND ANTIDEGRADATION REVIEW

- A Water Quality and Antidegradation Review (WQAR) assumes that [10 CSR 20-6.010(2) Continuing Authorities and 10 CSR 20-6.010(4)(A)5.B., consideration for no discharge] has been or will be addressed in a Missouri State Operating Permit or Construction Permit Application.
- A WQAR does not indicate approval or disapproval of alternative analysis as per [10 CSR 20-7.015(4) Losing Streams], and/or any section of the effluent regulations.
- Changes to Federal and State Regulations (FSR) made after the drafting of this WQAR may alter Water Quality Based Effluent Limits (WQBEL).
- Effluent limitations derived from FSR may be WQBEL or Effluent Limit Guidelines (ELG).
- WQBEL supersede ELG only when they are more stringent. Mass limits derived from technology based limits are still appropriate.
- A WQAR does not allow discharges to waters of the State, and shall not be construed as a National Pollution Discharge Elimination System (NPDES) or Missouri State Operating Permit to discharge or a permit to construct, modify, or upgrade.
- Limitations and other requirements in a WQAR may change as Water Quality Standards (WQS), Methodology, and Implementation procedures change.
- Nothing in this WQAR removes any obligations to comply with county or other local ordinances or restrictions.
- If the proposed treatment technology is not covered in 10 CSR 20-8 Design Guides, the treatment process may be considered a new technology. As a new technology, the permittee will need to work with the review engineer to ensure equipment is sized properly. The operating permit may contain additional requirements to evaluate the effectiveness of the technology once the facility is in operation. This Antidegradation Review is based on the information provided by the facility and is not a comprehensive review of the proposed treatment technology. If the review engineer determines the proposed technology will not consistently meet proposed effluent limits, the permittee will be required to revise their Antidegradation Report.

9. ANTIDEGRADATION REVIEW PRELIMINARY DETERMINATION

The proposed facility discharge for American Foods Group Wastewater Treatment Facility will result in significant degradation of the tributary to Peruque Creek. The Preferred Alternative #1 of 5-Stage Bardenpho CAS with Filtration & Chemical Addition was determined to be the base case technology, lowest cost alternative that meets technology and water quality based effluent limitations. The cost effectiveness of the other technologies were evaluated, and the base case alternative was found to be the preferred alternative.

It has also been determined that the other treatment option presented (Alternative 2 and the Base Project) may also be considered a reasonable alternative provided they are designed to be capable of meeting the effluent limitations developed based on the preferred alternative. If either Alternative 1 or 2 is selected, you may proceed with the

American Foods Development Co, LLC

March 2023

Page 16

appropriate facility plan, construction permit application, or other future submittals without the need to modify this Antidegradation review document.

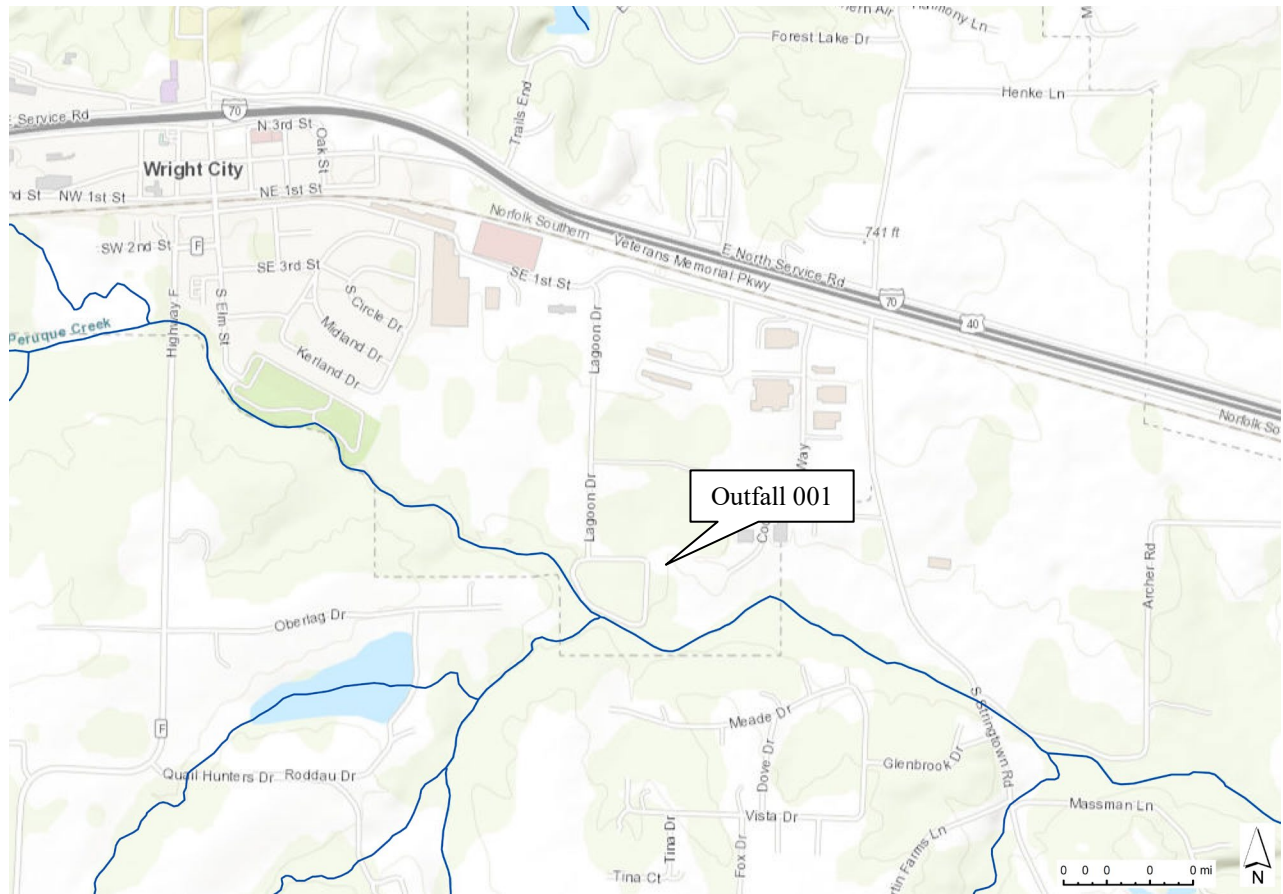
Per the requirements of the AIP, the effluent limits in this review were developed to be protective of beneficial uses and to attain the highest statutory and regulatory requirements. The Department has determined that the submitted review is sufficient and meets the requirements of the AIP. No further analysis is needed for this discharge.

Reviewer: Steve Hamm, P.E.

Date: January 2023

Section Chief: Cindy LePage, P.E. April 2023

Appendix A: Map of Discharge Location





March 22, 2022

Shannon Stang
41 Hutchins Dr
Portland, ME 04012

RE: Wright City South Wastewater Treatment Facility

Dear Shannon Stang:

On March 22, 2022, the Missouri Geological Survey received a request to perform a geohydrologic evaluation for the above referenced project located in Warren County. Included with this letter is a report that details the geologic and hydrologic conditions at the site and the potential for groundwater contamination in the event of wastewater treatment failure.

Thank you for the evaluation request. If you are in need of further assistance or have questions regarding the report, please contact our office at P.O Box 250, Rolla, Mo 65402-0250, by telephone at 573-368-2100 or gspg@dnr.mo.gov.

Sincerely,


MISSOURI GEOLOGICAL SURVEY


John Corley
Geologist
Environmental Geology Section

c: Chris Horvath
WPP
St. Louis Regional Office



03/22/2022

 Missouri Department Of Natural Resources Missouri Geological Survey Geological Survey Program Environmental Geology Section		Project ID Number LWE22083 County Warren
Request Details		
Project: Wright City South Wastewater Treatment Facility		Legal Description: 22 T47N R01W Quadrangle: WRIGHT CITY Latitude: 38 49 8.49 Longitude: -91 0 20.88
<u>Organization Official</u> Name: Chris Horvath Address: 100 Water Drive City: O'Fallon State: MO Zip: 63368 Phone: 636-561-3737 Email: chorvath@waterdistrict2.com		<u>Preparer</u> Name: Shannon Stang Address: 41 Hutchins Dr City: Portland State: ME Zip: 04012 Phone: 207-558-3744 Email: sstang@woodardcurran.com
Project Details		
Report Date: 03/22/2022 Date of Field Visit: 03/02/2022		Previous Reports: Not Applicable
<u>Facility Type</u> <input checked="" type="checkbox"/> Mechanical treatment plant <input type="checkbox"/> Recirculating filter bed <input type="checkbox"/> Land application <input type="checkbox"/> Lagoon or storage basin <input type="checkbox"/> Subsurface soil absorption system <input type="checkbox"/> Lagoon or storage basin W/Land App <input type="checkbox"/> Lagoon or storage basin W/SSAS <input type="checkbox"/> Other type of facility	<u>Type of Waste</u> <input type="checkbox"/> Animal <input checked="" type="checkbox"/> Human <input type="checkbox"/> Process or industrial <input type="checkbox"/> Leachate <input type="checkbox"/> Other waste type	<u>Funding Source</u> <input checked="" type="checkbox"/> IWT <input type="checkbox"/> WWL-SRF <u>Additional Information</u> <input checked="" type="checkbox"/> Plans were submitted <input type="checkbox"/> Site was investigated by NRCS <input type="checkbox"/> Soil or geotechnical data were submitted
Geologic Stream Classification: <input checked="" type="checkbox"/> Gaining <input type="checkbox"/> Losing <input type="checkbox"/> No discharge		
<u>Overall Geologic Limitations</u> <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe	<u>Collapse Potential</u> <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe	<u>Topography</u> <input checked="" type="checkbox"/> <4% <input type="checkbox"/> 4% to 8% <input type="checkbox"/> 8% to 15% <input type="checkbox"/> >15%
<u>Landscape Position</u> <input type="checkbox"/> Broad uplands <input type="checkbox"/> Floodplain <input type="checkbox"/> Ridgetop <input checked="" type="checkbox"/> Alluvial plain <input type="checkbox"/> Hillslope <input type="checkbox"/> Terrace <input type="checkbox"/> Narrow ravine <input type="checkbox"/> Sinkhole		
<u>Bedrock:</u> Bedrock consists of Mississippian-age Burlington-Keokuk Limestone.		
<u>Surficial Materials:</u> Surficial materials consist of moderate to highly permeable sandy, silty, and gravelly alluvium.		

 Missouri Department Of Natural Resources Missouri Geological Survey Geological Survey Program Environmental Geology Section		Project ID Number LWE22083 County Warren
<u>Recommended Construction Procedures for Earthen Facility</u> <input type="checkbox"/> Installation of clay pad and Compaction <input type="checkbox"/> Diversion of subsurface flow <input type="checkbox"/> Artificial sealing <input type="checkbox"/> Rock excavation <input type="checkbox"/> Limit excavation depth	<u>Determine Overburden Properties</u> <input type="checkbox"/> Particle size analysis <input type="checkbox"/> Atterberg limits <input type="checkbox"/> 95% Max. dry density test method <input type="checkbox"/> Overburden thickness <input type="checkbox"/> Permeability coefficient-undisturbed <input type="checkbox"/> Permeability coefficient-remolded	<u>Determine Hydrologic Conditions</u> <input type="checkbox"/> Groundwater elevation <input type="checkbox"/> Direction of groundwater flow <input type="checkbox"/> 25-Year flood level <input checked="" type="checkbox"/> 100-Year flood level

Remarks:

On March 2, 2022, a geologist with the Geological Survey Program (GSP) performed a geohydrologic evaluation for the proposed mechanical wastewater treatment facility that will serve Wright City, Missouri. It is proposed that the existing lagoons at the Wright City South Wastewater Treatment Facility will act as flow equalization basins when the new mechanical treatment plant is operational. The purpose of the site visit was to observe the geologic and hydrologic elements, determine geologic limitations, and determine the potential for groundwater contamination in the event of wastewater treatment failure. This report (LWE22083) regards the proposed mechanical treatment plant; report LWE22071 regards the existing onsite lagoons.

The proposed treatment plant site is located on a flat-lying alluvial terrace located north of the existing lagoons. No bedrock was observed at the site of the proposed mechanical treatment plant, but previous mapping indicates that bedrock consists of Mississippian-age Burlington-Keokuk Limestone. The Burlington-Keokuk Limestone is a coarsely crystalline limestone that exhibits low primary porosity, but can exhibit secondary porosity if solution weathering has created conduits in the bedrock. Surficial materials onsite consist of loess and alluvial material, which may include lenses of silts/clays, sands, and gravels of varying permeabilities. Based on logs of nearby wells, surficial material thickness in this area is approximately 100 feet.

The facility's outfall discharges to a tributary of Peruque Creek, in which the tributary and Peruque Creek exhibited gaining characteristics and will be classified as such. In the event of wastewater treatment failure, shallow groundwater and surface waters of Peruque Creek and its tributaries may be adversely impacted. The mechanical treatment plant site receives a slight geologic limitations rating.



March 22, 2022

Shannon Stang
41 Hutchins Dr
Portland, ME 04012

RE: Wright City South Wastewater Treatment Facility

Dear Shannon Stang:

On February 04, 2022, the Missouri Geological Survey received a request to perform a geohydrologic evaluation for the above referenced project located in Warren County. Included with this letter is a report that details the geologic and hydrologic conditions at the site and the potential for groundwater contamination in the event of wastewater treatment failure.

Thank you for the evaluation request. If you are in need of further assistance or have questions regarding the report, please contact our office at P.O Box 250, Rolla, Mo 65402-0250, by telephone at 573-368-2100 or gspeg@dnr.mo.gov.

Sincerely,


MISSOURI GEOLOGICAL SURVEY


John Corley
Geologist
Environmental Geology Section

c: Chris Horvath
WPP
St. Louis Regional Office



03/22/2022

 Missouri Department Of Natural Resources Missouri Geological Survey Geological Survey Program Environmental Geology Section		Project ID Number LWE22071 County Warren
Request Details		
Project: Wright City South Wastewater Treatment Facility		Legal Description: 22 T47N R01W Quadrangle: WRIGHT CITY Latitude: 38 49 8.64 Longitude: -91 0 20.68
<u>Organization Official</u> Name: Chris Horvath Address: 100 Water Drive City: O'Fallon State: MO Zip: 63368 Phone: 636-561-3737 Email: chorvath@waterdistrict2.com		<u>Preparer</u> Name: Shannon Stang Address: 41 Hutchins Dr City: Portland State: ME Zip: 04012 Phone: 207-558-3744 Email: sstang@woodardcurran.com
Project Details		
Report Date: 03/22/2022 Date of Field Visit: 03/02/2022		Previous Reports: Not Applicable
<u>Facility Type</u> <input type="checkbox"/> Mechanical treatment plant <input type="checkbox"/> Recirculating filter bed <input type="checkbox"/> Land application <input checked="" type="checkbox"/> Lagoon or storage basin <input type="checkbox"/> Subsurface soil absorption system <input type="checkbox"/> Lagoon or storage basin W/Land App <input type="checkbox"/> Lagoon or storage basin W/SSAS <input type="checkbox"/> Other type of facility	<u>Type of Waste</u> <input type="checkbox"/> Animal <input checked="" type="checkbox"/> Human <input type="checkbox"/> Process or industrial <input type="checkbox"/> Leachate <input type="checkbox"/> Other waste type	<u>Funding Source</u> <input checked="" type="checkbox"/> IWT <input type="checkbox"/> WWL-SRF <u>Additional Information</u> <input checked="" type="checkbox"/> Plans were submitted <input type="checkbox"/> Site was investigated by NRCS <input type="checkbox"/> Soil or geotechnical data were submitted
Geologic Stream Classification: <input checked="" type="checkbox"/> Gaining <input type="checkbox"/> Losing <input type="checkbox"/> No discharge		
<u>Overall Geologic Limitations</u> <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Severe	<u>Collapse Potential</u> <input type="checkbox"/> Not applicable <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe	<u>Topography</u> <input checked="" type="checkbox"/> <4% <input type="checkbox"/> 4% to 8% <input type="checkbox"/> 8% to 15% <input type="checkbox"/> >15%
<u>Landscape Position</u> <input type="checkbox"/> Broad uplands <input type="checkbox"/> Floodplain <input type="checkbox"/> Ridgetop <input checked="" type="checkbox"/> Alluvial plain <input type="checkbox"/> Hillslope <input type="checkbox"/> Terrace <input type="checkbox"/> Narrow ravine <input type="checkbox"/> Sinkhole		
<u>Bedrock:</u> Bedrock consists of Mississippian-age Burlington-Keokuk Limestone.		
<u>Surficial Materials:</u> Surficial materials consist of moderate to highly permeable sandy, silty, and gravelly alluvium.		

 Missouri Department Of Natural Resources Missouri Geological Survey Geological Survey Program Environmental Geology Section		Project ID Number LWE22071 County Warren
Recommended Construction Procedures for Earthen Facility <input checked="" type="checkbox"/> Installation of clay pad and Compaction <input type="checkbox"/> Diversion of subsurface flow <input type="checkbox"/> Artificial sealing <input type="checkbox"/> Rock excavation <input type="checkbox"/> Limit excavation depth	Determine Overburden Properties <input checked="" type="checkbox"/> Particle size analysis <input checked="" type="checkbox"/> Atterberg limits <input checked="" type="checkbox"/> 95% Max. dry density test method <input type="checkbox"/> Overburden thickness <input type="checkbox"/> Permeability coefficient-undisturbed <input checked="" type="checkbox"/> Permeability coefficient-remolded	Determine Hydrologic Conditions <input type="checkbox"/> Groundwater elevation <input type="checkbox"/> Direction of groundwater flow <input type="checkbox"/> 25-Year flood level <input checked="" type="checkbox"/> 100-Year flood level


Remarks:

On March 2, 2022, a geologist with the Geological Survey Program (GSP) performed a geohydrologic evaluation for the proposed mechanical wastewater treatment plant that will serve Wright City, Missouri. It is proposed that the existing lagoons at the Wright City South Wastewater Treatment Facility will act as flow equalization basins when the new mechanical treatment plant is operational. The purpose of the site visit was to observe the geologic and hydrologic elements, determine geologic limitations and collapse potential of the proposed and existing treatment facilities on site, and determine the potential for groundwater contamination in the event of wastewater treatment failure. This report (LWE22071) regards the existing lagoons; report LWE22083 regards the proposed mechanical treatment plant.

No bedrock was observed at the site, but previous mapping indicates that bedrock consists of Mississippian-age Burlington-Keokuk Limestone. The Burlington-Keokuk Limestone is a coarsely crystalline limestone that exhibits low primary porosity, but can exhibit secondary porosity if solution weathering has created conduits in the bedrock. Surficial materials onsite consist of loess and alluvial material, which may include lenses of silts/clays, sands, and gravels of varying permeabilities. Based on logs of nearby wells, surficial material thickness in this area is approximately 100 feet.

The facility's existing outfall discharges to a tributary of Peruque Creek, in which the tributary and Peruque Creek exhibited gaining characteristics and will be classified as such. In the event of wastewater treatment failure, shallow groundwater and surface waters of Peruque Creek and its tributaries may be adversely impacted. The existing lagoons receive a moderate geologic limitations rating primarily due to the lagoons' placement on an alluvial plain, and receive a slight collapse potential rating.

Appendix C: Antidegradation Review Summary Attachments

 MISSOURI DEPARTMENT OF NATURAL RESOURCES WATER PROTECTION PROGRAM, WATER POLLUTION CONTROL BRANCH ANTIDEGRADATION REVIEW SUMMARY / REQUEST		FOR DEPARTMENT USE ONLY APP NO. _____ FEE RECEIVED _____ CHECK NO. _____ DATE RECEIVED _____	
1. FACILITY			
NAME Wright City South Wastewater Treatment Facility		COUNTY Warren	
ADDRESS (PHYSICAL) 100 Lagoon Road	CITY Wright City	STATE MO	ZIP CODE 663390
PERMIT NUMBER MO-0023191	PROPOSED DESIGN FLOW 3.5 MGD	SIC / NAICS CODE 4952/221320	
2. OWNER			
NAME American Foods Group (AFG)		Attention: Jeff Jones, Senior Director Environmental Health & Safety	
ADDRESS 500 S Washington St.	CITY Green Bay	STATE WI	ZIP CODE 54301
EMAIL ADDRESS jjones@americanfoodsgroup.com		TELEPHONE NUMBER WITH AREA CODE 920-436-6522	
3. CONTINUING AUTHORITY The regulatory requirement regarding continuing authority is found in 10 CSR 20-8.010(2).			
NAME Same As Owner In Part 2		SECRETARY OF STATE CHARTER NUMBER	
ADDRESS	CITY	STATE	ZIP CODE
EMAIL ADDRESS		TELEPHONE NUMBER WITH AREA CODE	
4. CONSULTANT			
PREPARER NAME Robert Polys, P.E.		COMPANY NAME Woodard & Curran, Inc.	
ADDRESS 1520 South Fifth Street, Suite 273	CITY St. Charles	STATE MO	ZIP CODE 63303
EMAIL ADDRESS rpolys@woodardcurran.com		TELEPHONE NUMBER WITH AREA CODE (207)-253-9788	
5. RECEIVING WATER BODY SEGMENT #1			
NAME Tributary to Peruque Creek			
5.1 Upper end of segment – Location of discharge UTM: X= _____, Y= _____ OR Lat 38.8182, Long -91.0051			
5.2 Lower end of segment – UTM: X= _____, Y= _____ OR Lat 38.7990, Long -90.8590			
Per the Missouri Antidegradation Implementation Procedure (AIP), the definition of a segment, "a segment is a section of water that is bound, at a minimum, by significant existing sources and confluences with other significant water bodies."			
6. WATER BODY SEGMENT #2 (IF APPLICABLE, Use another form if a third segment is needed)			
NAME			
6.1 Upper end of segment – End of Segment #1 UTM: X= _____, Y= _____ OR Lat _____, Long _____			
6.2 Lower end of segment – UTM: X= _____, Y= _____ OR Lat _____, Long _____			
7. DECHLORINATION			
If chlorination and dechlorination is the existing or proposed method of disinfection treatment, will the effluent discharged be equal to or less than the Water Quality Standards for Total Residual Chlorine stated in Table A1 of 10 CSR 20-7.031? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No – What is the proposed method of disinfection? UV Disinfection			
Based on the disinfection treatment system being designed for total removal of Total Residual Chlorine, minimal degradation for Total Residual Chlorine is assumed and the facility will be required to meet the water quality based effluent limits. These compliance limits for Total Residual Chlorine are much less than the method detection limit of 0.13 mg/L.			

8. SUMMARIZE THE FEASIBILITY OF CONSTRUCTING A NO-DISCHARGE TREATMENT WASTEWATER FACILITY

According to the Antidegradation Implementation Procedure Sections I.B. and II.B.1., the feasibility of no-discharge alternatives must be considered. No-discharge alternatives may include connection to a regional treatment facility, surface land application, subsurface land application, and recycle or reuse.

Six no-discharge alternatives were analyzed and none were viable: (1) Land application is an impractical alternative due to the large amount of land required to be purchased, and its associated financial burden on the District. The land required would generate much less revenue than if it was left available for development or farmland. (2) Subsurface disposal is impractical due to the required land to be completely dug up and reconstructed to install the subsurface distribution and disposal system, likely steering farmers away from allowing any long-term leases or easements as they wouldn't be able to grow their crops during construction and plowing of the field would not be possible. (3) Recycling or reuse is infeasible because the typical daily discharge would never be fully used by the WWTF's in-plant not potable water system for daily operations. This would require another source of disposal/use. Many of the potential reuse options could result in further degradation to the environment. (4) Diversion of flow to another WWTF is infeasible because of insufficient land to expand neighboring WWTFs, high costs of wastewater transport to another site, and high costs of upgrades for additional capacity at these WWTFs. (5) An alternative discharge location is impractical because Perque Creek is one of the only sizable potential receiving waters in the immediate area, and additional capacity upgrades would still need to be made at the WWTF. (6) Improved operations & maintenance is impractical because the District and WWTF staff are currently maximizing the WC WWTF hydraulic and treatment capacity to its fullest available extent.

9. ADDITIONAL REQUIREMENTS

Complete and submit the following with this submittal:

- ☒ Copy of the Geohydrologic Evaluation – Submit request through the Missouri Geological Survey website
- ☒ Copy of the Missouri Natural Heritage from the Missouri Department of Conservation website
- ☒ Attach your Antidegradation Review Report and all supporting documentation as these forms are only a summary.
- ☐ If applicable, submit a copy of any Existing Water Quality data used in this process. Include the date range of the data, source(s) of the data, and location of data collection relative to the outfall. If using your own collected water quality data, submit a copy of the Quality Assurance Project Plan (QAPP) approved by the department's Watershed Protection Section. For more detailed information, see the Missouri Antidegradation Implementation Procedure (AIP), Section II.A.1.

10. PATH / TIER REVIEW ATTACHMENTS ENCLOSED

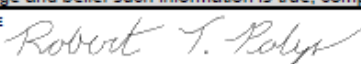
Path A: Tier 2 – Non-Degradation Mass Balance	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Path B: Tier 2 – Minimal Degradation	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Path C: Tier 2 – Significant Degradation	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Path D: Tier 1 – Preliminary Review Request	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Path E: Temporary Degradation	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

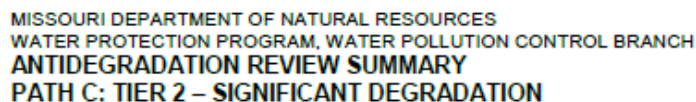
11. APPLICANT PROPOSED ANTIDegradATION REVIEW EFFLUENT LIMITS

Preliminary effluent limits for the proposed project are dependent upon the path selected:

Applicable Pollutants of Concern	Concentration*		Path / Tier Review Attachment Used for POC Evaluation	Average Monthly Limit	Daily Maximum Limit or Average Weekly Limit
	mg/L	µg/L			
BOD ₅	X		Path C	10 mg/L	
TSS	X		Path C	10 mg/L	
Ammonia (Summer)	X		Path C	1.4 mg/L	3.6 mg/L
Ammonia (Winter)	X		Path C	2.9 mg/L	7.5 mg/L
Total Phosphorus			Path C	14.6 lbs/day	
Total Nitrogen			Path C	292 lbs/day	
Dissolved Oxygen	X		-----		6 mg/L (Min Day)
pH			-----		6.5-9 S.U.
Bacteria - E. Coli (April 1st to Oct. 30th)			-----	206/100mL	1,030/100mL

* Place an X in appropriate box for the concentration units for each Pollutant of Concern.

12. PROPOSED PROJECT SUMMARY	
<p>The proposed project will decommission the existing WC WWTF and construct a new WWTF on the adjacent property to increase treatment capacity and meet more stringent effluent limits proposed in the current discharge permit. The existing lagoon system is currently at capacity and will not be able to meet the new proposed treatment limits. The new WWTF will be an activated sludge system (CAS) in a 5-Stage Bardenpho configuration. The WWTF will include a new Influent Lift Station (municipal flow), Headworks facilities, biological treatment tanks (5-Stage Bardenpho), Final Clarifiers, Tertiary Filtration, UV Disinfection, Reaeration System and a new Outfall. New Aerobic Sludge Storage Tanks and mechanical Sludge Dewatering with offsite cake disposal will also be included. The existing lagoons (or a portion of them) will be converted to offline emergency equalization tanks. The design flow for the proposed WWTF upgrade will be 3.5 MGD. This new design flow accommodates 0.5 MGD from the existing user base in Wright City, 1.5 MGD for future growth and expansion in the community, and 1.5 MGD for the new AFG facility.</p>	
<p>Applicants choosing to use a new wastewater technology that are considered an "unproven technology" in Missouri must comply with the requirements set forth in the <i>New Technology Definitions and Requirements fact sheet</i>.</p>	
13. CONTINUING AUTHORITY WAIVER (For New Discharges)	
<p>In accordance with 10 CSR 20-6.010(2)(C), applicants proposing use of a lower preference continuing authority, when the higher level authority is available, must submit a waiver from the existing higher authority one or other documentation for the department's review, provided it does not conflict with any area-wide management plan approved under section 208 of the Federal Clean Water Act or by the Missouri Clean Water Commission. Is the waiver necessary? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, provide a copy.</p>	
14. APPLICATION FEE	
<input type="checkbox"/> CHECK NUMBER	<input type="checkbox"/> JETPAY CONFIRMATION NUMBER
15. SIGNATURE	
<p>I am authorized and hereby certify that I am familiar with the information contained in this document and to the best of my knowledge and belief such information is true, complete and accurate.</p>	
SIGNATURE 	DATE March 4, 2022
PRINT NAME Robert T. Polys	TITLE Senior Principal
PLEASE IDENTIFY YOUR STATUS FOR THIS PROJECT: <input type="checkbox"/> OWNER <input type="checkbox"/> CONTINUING AUTHORITY <input checked="" type="checkbox"/> CONSULTANT	



Warren

Pollutants of Concern to be considered include those pollutants reasonably expected to be present in the discharge per the Antidegradation Implementation Procedure Section II.A. and assumed or demonstrated to cause significant degradation. The tier protection levels are specified and defined in rule at 40 CSR 20-7.031(2).

[illegible]

¹¹ Provide the Basis for the Base Case Limit: WQS – Water Quality Standard, WLA – Wasteload Allocation, ELG – Effluent Limit Guideline, or describe other.

Supply a summary of the non-discharging alternatives considered. "For Discharges likely to cause significant degradation, an analysis of non-degrading and less-degrading alternatives must be provided," as stated in the Antidegradation Implementation Procedure Section II.B.1. These alternatives include no-discharge. Attach all supportive documentation in the Antidegradation Review report.

Six no-discharge alternatives were analyzed and none were viable. (1) Land application is an impractical alternative due to the large amount of land required to be purchased, and its associated financial burden on the District. The land required would generate much less revenue than if it was left available for development or farmland. (2) Subsurface disposable is impractical due to the required land to be completely dug up and reconstructed to install the subsurface distribution and disposal system, likely steering farmers away from allowing any long-term leases or easements as they wouldn't be able to grow their crops during construction and plowing of the field would not be possible. (3) Recycling or reuse is infeasible because the typical daily discharge would never be fully used by the WWTF's in-plant not potable water system for daily operations. This would require another source of disposal/use. Many of the potential reuse options could result in further degradation to the environment. (4) Diversion of flow to another WWTF is infeasible because of insufficient land to expand neighboring WWTFs, high costs of wastewater transport to another site, and high costs of upgrades for additional capacity at these WWTFs. (5) An alternative discharge location is impractical because Peruque Creek is one of the only sizable potential receiving waters in the immediate area, and additional capacity upgrades would still need to be made at the WWTF. (6) Improved operations & maintenance is impractical because the District and WWTF staff are currently maximizing the WC WWTF hydraulic and treatment capacity to its fullest available extent.

Minimum of three (preferably five or more) discharging alternatives* ranging from less-degrading to degrading including Preferred Alternative (All treatment levels for POCs must at a minimum meet water quality standards):		
Discharging Alternative #	Treatment Type	Description
1	CAS-5 Stage Bardenpho	5-Stage Bardenpho With Tertiary Filtration
2	CAS-5 Stage Bardenpho	5-Stage Bardenpho With Tertiary Filtration & Chemical Addition
3	Membrane Bioreactor (MBR)	MBR With 5-Stage BNR & Chemical Addition
4		
5		
6		
* Same technology may be multiple alternatives as you have the base unit and add to it with more capacity to provide additional treatment.		
4. DETERMINATION OF THE REASONABLE ALTERNATIVE		
<p>Per the Antidegradation Implementation Procedure Section II.B.2, "a reasonable alternative is one that is practicable, economically efficient and affordable." Provide basis and supporting documentation in the Antidegradation Review report. Please do not write "See Report" for any box below.</p> <p>Practicability Summary:</p> <p>"The practicability of an alternative is considered by evaluating the effectiveness, reliability, and potential environmental impacts," according to the Antidegradation Implementation Procedure Section II.B.2.a. Examples of factors to consider, including secondary environmental impacts, are given in the Antidegradation Implementation Procedure Section II.B.2.a.</p> <p>All of the No-Discharge Alternatives are not practical for this project. All three of the Discharging Alternatives are practical and proven technologies for detailed consideration given the pollutants of concern and the anticipated limits associated with the pollutants of concern.</p>		
<p>Economic Efficiency Basis:</p> <p>What is the design life cycle for the comparison? 20-Years</p> <p>What interest rate was used in the present worth calculations? 0.25% - Current Federal Discount Rate</p>		
<p>Economic Efficiency Summary:</p> <p>Alternatives that are deemed practicable must undergo a direct cost comparison in order to determine economic efficiency. Means to determine economic efficiency are provided in the Antidegradation Implementation Procedure Section II.B.2.b.</p> <p>Both the Base Case Alternative (CAS 5-Stage Bardenpho With Filtration) and Less Degrading Alternative #1 (CAS 5-Stage Bardenpho With Filtration & Chemical Addition) are Economically Viable Alternatives. Less Degrading Alternative #2 - Membrane Bioreactor is not Economically Viable as an alternative due to the high up-front cost and total life cycle cost which exceeds 120% of the Base Case alternative.</p>		

TABLE OF THE ALTERNATIVES EVALUATION (Attach additional page if necessary)						
PARAMETERS	Alternatives #					
	1	2	3	4	5	6
BODs – mg/L	< 10	< 5-10	< 5			
TSS – mg/L	< 10	< 5-10	< 1			
Ammonia (Summer) – mg/L	< 1	< 1	< 1			
Ammonia (Winter) – mg/L	< 1	< 1	< 1			
E. Coli – #/100 mL	< 206	< 206	< 206			
Total Nitrogen – mg/L	< 5-10	< 5-10	< 3-5			
Total Phosphorus – mg/L	< 1	< 1	< 1			
Dissolved Oxygen (Daily Min.)	> 6	> 6	> 6			
pH	6.5-9 S.U.	6.5-9 S.U.	6.5-9 S.U.			
Construction Cost – \$	\$98.5M	\$98.6M	\$127.6M			
Operating Cost – \$	\$39.32M	\$43.37M	\$49.1M			
Present Worth – \$	\$137.8M	\$141.9M	\$176.7M			
Ratio present worth to base case	1	1.03	1.3			
Affordability Summary: Alternatives identified as most practicable and economically efficient are considered affordable if the applicant does not supply an affordability analysis. An affordability analysis per the Antidegradation Implementation Procedure Section II.B.2.c, "may be used to determine if the alternative is too expensive to reasonably implement." Both the Base Case Alternative (CAS 5-Stage Bardenpho With Filtration) and Less Degrading Alternative #1 (CAS 5-Stage Bardenpho With Filtration & Chemical Addition) are Economically Viable Alternatives. Less Degrading Alternative #2 - Membrane Bioreactor is not Economically Viable as an alternative due to the high up-front cost and total life cycle cost which exceeds 120% of the Base Case alternative.						
Justification for Preferred Alternative: As shown in the table the operation and maintenance costs for the MBR alternative are higher than the other alternatives. This is due to the higher annual electricity use along with added costs for membrane replacement, chemical use, additional unit processes and other short-lived assets. The initial capital costs for the MBR alternative are the highest due to the high cost of the membrane equipment and the additional associated supporting equipment. The MBR treatment alternative is also not well suited for certain industrial type wastes such as those planned from AFG that may at times have fats, oils, greases or secretions which would foul and permanently damage the membranes. For these reasons Alternative #3 - MBR is not recommended. Alternative #2 - CAS-5-Stage Bardenpho with Filtration & Chemical Addition is recommended for the project due to its ability to provide nutrient removal along with better capabilities for industrial loading along with better high flow treatment capability.						
Reasons for Rejecting the other Evaluated Alternatives: The initial capital costs for the MBR alternative are the highest due to the high cost of the membrane equipment and the additional associated supporting equipment and this alternative is not economically viable. The MBR treatment alternative is also not well suited for certain industrial type wastes such as those planned from AFG that may at times have fats, oils, greases or secretions which would foul and permanently damage the membranes. This alternative is also harder to operate during high flow conditions which may occur and requires additional supporting unit processes.						
Comments/Discussion:						

5. SOCIAL AND ECONOMIC IMPORTANCE OF THE PREFERRED ALTERNATIVE
<p>If the preferred alternative will result in significant degradation, then it must be demonstrated that it will allow important economic and social development in accordance to the Antidegradation Implementation Procedure Section II.E. Social and Economic Importance is defined as the social and economic benefits to the community that will occur from any activity involving a new or expanding discharge.</p>
<p>Identify the affected community:</p> <p>The affected community is defined in 10 CSR 20-7.031(2)(B) as the community "in the geographical area in which the waters are located. Per the Antidegradation Implementation Procedure Section II.E.1, "the affected community should include those living near the site of the proposed project as well as those in the community that are expected to directly or indirectly benefit from the project."</p> <p>The affected community is the City of Wright City. A portion of the City is already connected to the existing WC WWTF, however as that WWTF is at capacity no additional connections can occur at this time which is limiting growth and development in the community. The upgraded WC WWTF will be able to handle additional flow and load and will dramatically improve overall wastewater treatment as compared to the existing lagoon treatment system. The land directly around the WC WWTF consists of farmland along with commercial and industrial development which will not be negatively impacted by the proposed project.</p>
<p>Identify relevant factors that characterize the social and economic conditions of the affected community:</p> <p>Examples of social and economic factors are provided in the Antidegradation Implementation Procedure Section II.E.1., but specific community examples are encouraged.</p> <p>The average Median Household Income (MHI) in Warren County in 2019 was \$60,125. This Represents an increase of 3.76% from the MHI in 2018. The MHI for Warren County is above the average in the state of Missouri. The state average MHI in Missouri is \$55,461 as of 2015. It is anticipated that the MHI for Warren County will continue to rise due to the continued growth and development of this area of the state. Upgrades to the WC WWTF and a reliable way to handle sanitary sewer flow will further encourage this growth. In September 2015, the unemployment rates in Warren County were 4.0%. The State of Missouri averaged an unemployment rate of 4.5% in September of 2015. As previously stated, the additional treatment capacity will allow for more growth and development to occur in the area. Approximately 13.4% of Warren County residents were living with income below the poverty level in 2020 according to the US Census Bureau.</p>
<p>Describe the important social and economic development associated with the project:</p> <p>Determining benefits for the community and the environment should be site specific and in accordance with the Antidegradation Implementation Procedure Section II.E.1.</p> <p>As previously noted, the increased flow capacity will allow for growth to occur in the City. Growth in the City can generate the need for additional businesses and public facilities to serve the growth and development. The businesses and public facilities can create more jobs for the community as well as residents living outside the community that commute to work within the community. This will benefit the State to help bring the percentage of people living below the poverty level in Missouri down. The addition of the AFG facility to the area alone will add 1,300 new jobs.</p>
<p>PROPOSED PROJECT SUMMARY:</p> <p>The proposed project will decommission the existing WC WWTF and construct a new WWTF on the adjacent property to increase treatment capacity and meet more stringent effluent limits proposed in the current discharge permit. The existing lagoon system is currently at capacity and will not be able to meet the new proposed treatment limits. The new WWTF will be an activated sludge system (CAS) in a 5-Stage Bardenpho configuration. The WWTF will include a new Influent Lift Station (municipal flow), Headworks facilities, biological treatment tanks (5-Stage Bardenpho), Final Clarifiers, Tertiary Filtration, UV Disinfection, Reaeration System and a new Outfall. New Aerobic Sludge Storage Tanks and mechanical Sludge Dewatering with offsite cake disposal will also be included. The existing lagoons will be converted to offline emergency equalization tanks.</p> <p>The design flow for the proposed WWTF upgrade will be 3.5 MGD. This new design flow accommodates 0.5 MGD from the existing user base in Wright City, 1.5 MGD for future growth and expansion in the community, and 1.5 MGD for the new AFG facility.</p>
<p>Attach the Antidegradation Review report and all supporting documentation. This is a technical document, which must be signed, sealed and dated by a registered professional engineer of Missouri.</p>

Appendix D: Natural Heritage Review

	Missouri Department of Conservation Natural Heritage Review Report February 1, 2022	Science Branch P. O. Box 180 Jefferson City, MO 65102 Prepared by: Hannah Roos NaturalHeritageReview@mdc.mo.gov (573) 522 - 4115 ext. 3182
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Shannon Stang
Woodward & Curran
sstang@woodardcurran.com

NHR ERT ID:	10301	NHR ERT Level:	2
Project type:	Wastewater		
Location/Scope:	T47N R01W S22		
County:	Warren		
Query reference:	Wright City WWTF		
Query received:	1/25/2022		

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. On-site verification is the responsibility of the project. Natural Heritage records were identified at some time and location. This report considers records near but not necessarily at the project site. Animals move and, over time, so do plant communities. To say "there is a record" does not mean the species/habitat is still there. To say that "there is no record" does not mean a protected species will not be encountered. These records serve as one reference and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed to avoid or minimize impacts. More information is at <https://mdc.mo.gov/discover-nature/places/natural-areas> and https://mdc12.mdc.mo.gov/applications/mofwis/mofwis_search1.aspx

Level 3: Records of federal-listed (also state-listed) species or critical habitats near the project site:

Natural Heritage records identify no wildlife preserves, no designated wilderness areas or critical habitats, and no federal-listed species records within the project area, or in the public land survey section or sections adjacent.

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. Contact the U.S. Fish and Wildlife Service (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132) for Endangered Species Act coordination and concurrence information).

Level 2: Records of state-listed (not federal-listed) endangered species AND / OR state-ranked (not state-listed endangered) species and natural communities of conservation concern. The Department tracks these species and natural communities due to population declines and/or apparent vulnerability.

Natural Heritage records identify no state-listed endangered species within the project area.

Natural Heritage records identify no state-ranked species/natural communities within the project area.

There are no regulatory requirements associated with this status, however we encourage voluntary stewardship to minimize the risk of further decline that could lead to listing.

STATE ENDANGERED species are protected under the Wildlife Code of Missouri (3CSR10-4.111). See https://mdc.mo.gov/sites/default/files/mo_nature/downloads/2021_SOCC.pdf for a complete list of species and communities of conservation concern.

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific Natural Heritage records):

- **Wastewater:** Clean Water Act permits issued by other agencies ([Missouri DNR](#) or [US Army Corps of Engineers](#)) regulate both construction and operation of wastewater systems, and provide many

important protections for fish and wildlife resources throughout the project area and at some distance downstream. Fish and wildlife almost always benefit when unnatural pollutants are removed from water, and concerns are minimal if construction is managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any "Clean Water Permit" conditions.

- Revegetation of disturbed areas is recommended to minimize erosion, as is restoration with of native plant species compatible with the local landscape and for wildlife needs. Annuals like ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as Crown Vetch and *Sericea lespedeza*.
 - Management Recommendations for Construction Projects Affecting Missouri Streams and Rivers is a Conservation Department publication available at <https://live-mdc8.pantheonsite.io/sites/default/files/2020-06/Streams.pdf>.
- **Karst:** Warren County has known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. See <https://live-mdc8.pantheonsite.io/sites/default/files/2020-06/Karst.pdf> for best management recommendations.
- **Indiana Bats and/or Northern Long-eared Bats** occur in Warren County and could occur in the project area. Indiana Bats (*Myotis sodalis*, federal and state-listed endangered) and Northern Long-eared Bats (*Myotis septentrionalis*, federal-listed threatened) hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana Bats and/or Northern Long-eared Bats, especially from September to April. **If any trees need to be removed by your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.**
- Invasive exotic species are a significant issue for fish, wildlife, and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.
- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
 - Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
 - When possible, wash and rinse equipment thoroughly with hard spray or HOT water ($\geq 140^{\circ}\text{F}$, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.

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- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
 - Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
 - When possible, wash and rinse equipment thoroughly with hard spray or HOT water ($\geq 140^{\circ}\text{F}$, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.



Missouri Department of Conservation

Missouri Department of Conservation's Mission is to protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.

Natural Heritage Review Level Two Report: State Listed Endangered Species and/or Missouri Species/Natural Communities of Conservation Concern

There are records of state-listed Endangered Species, or Missouri Species or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact Missouri Department of Conservation for further coordination.

Foreword: Thank you for accessing the Missouri Natural Heritage Review Website developed by the Missouri Department of Conservation with assistance from the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Missouri Department of Transportation and NatureServe. The purpose of this website is to provide information to federal, state and local agencies, organizations, municipalities, corporations and consultants regarding sensitive fish, wildlife, plants, natural communities and habitats to assist in planning, designing and permitting stages of projects.

PROJECT INFORMATION

Project Name and ID Number: Wright City WWTF #10301

User Project Number: 0233703.01

Project Description: Wright City WWTF Upgrades, 38° 49' 05.98"N 91° 00' 18.33"W, Peruque Creek (07110009-0101), Warren County

Project Type: Waste Transfer, Treatment, and Disposal, Liquid waste/Effluent, Wastewater treatment plant, Construction or expansion

Contact Person: Robert Polys

Contact Information: sstang@woodardcurran.com or 2075583744

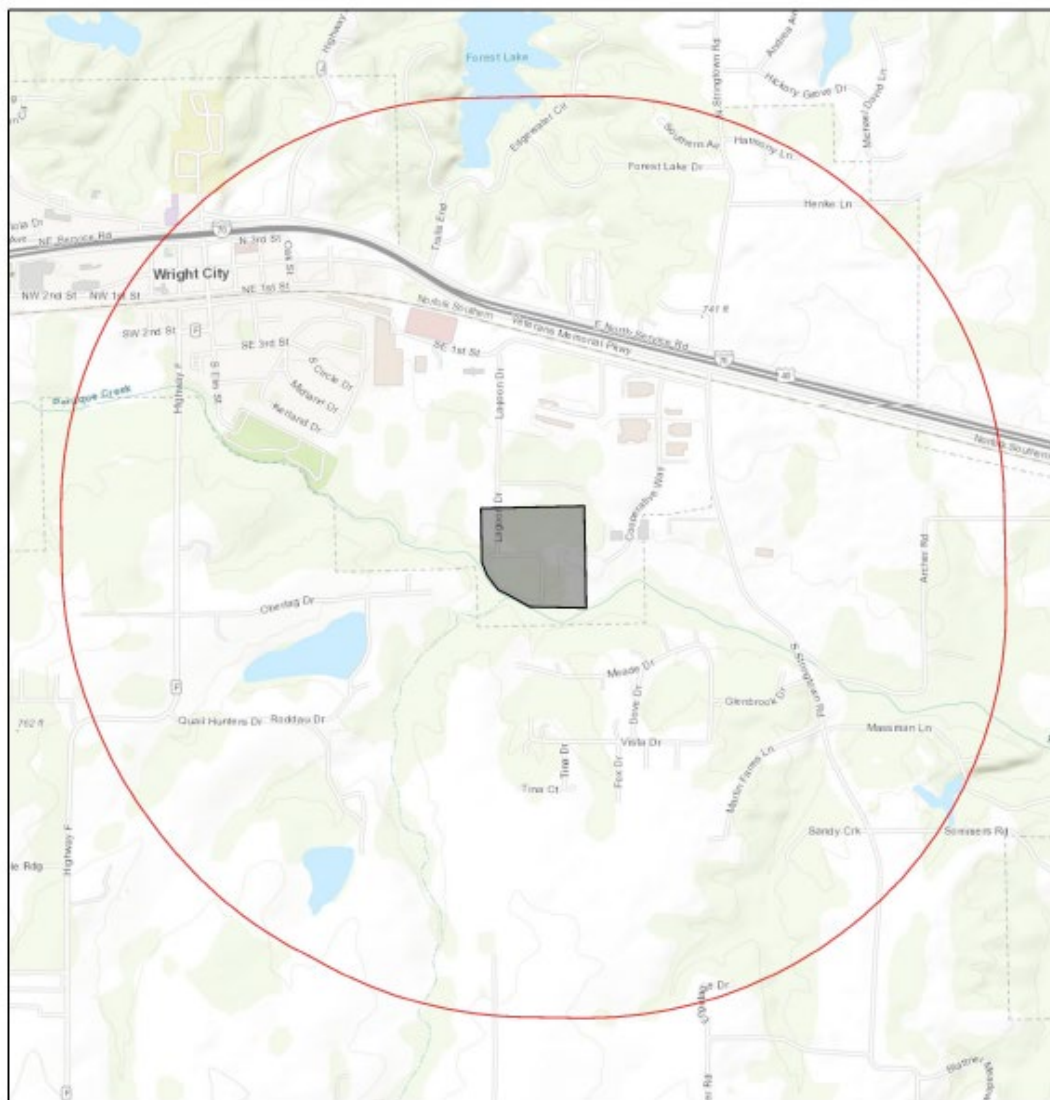
Disclaimer: The NATURAL HERITAGE REVIEW REPORT produced by this website identifies if a species tracked by the Natural Heritage Program is known to occur within or near the area submitted for your project, and shares suggested recommendations on ways to avoid or minimize project impacts to sensitive species or special habitats. If an occurrence record is present, or the proposed project might affect federally listed species, the user must contact the Department of Conservation or U.S. Fish and Wildlife Service for more information. The Natural Heritage Program tracks occurrences of sensitive species and natural communities where the species or natural community has been found. Lack of an occurrence record does not mean that a sensitive plant, animal or natural community is not present on or near the project area. Depending on the project, current habitat conditions, and geographic location in the state, surveys may be necessary. Additionally, because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, Reports include information about records near but not necessarily on the project site.

The Natural Heritage Report is not a site clearance letter for the project. It provides an indication of whether or not public lands and sensitive resources are known to be (or are likely to be) located close to the proposed project. Incorporating information from the Natural Heritage Program into project plans is an important step that can help reduce unnecessary impacts to Missouri's sensitive fish, forest and wildlife resources. However, the Natural Heritage Program is only one reference that should be used to evaluate potential adverse project impacts. Other types of information, such as wetland and soils maps and on-site inspections or surveys, should be considered. Reviewing current landscape and habitat information, and species' biological characteristics would additionally ensure that Missouri Species of Conservation Concern are appropriately identified and addressed in planning efforts.

U.S. Fish and Wildlife Service – Endangered Species Act (ESA) Coordination: Lack of a Natural Heritage Program occurrence record for federally listed species in your project area does not mean the species is not present, as the area may never have been surveyed. Presence of a Natural Heritage Program occurrence record does not mean the project will result in negative impacts. The information within this report is not intended to replace Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS) for listed species. Direct contact with the USFWS may be necessary to complete consultation and it is required for actions with a federal connection, such as federal funding or a federal permit; direct contact is also required if ESA concurrence is necessary. Visit the USFWS Information for Planning and Conservation (IPaC) website at <https://ecos.fws.gov/ipac/> for further information. This site was developed to help streamline the USFWS environmental review process and is a first step in ESA coordination. The Columbia Missouri Ecological Field Services Office may be reached at 573-234-2132, or by mail at 101 Park Deville Drive, Suite A, Columbia, MO 65203.

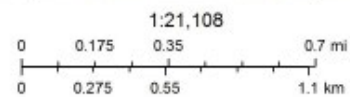
Transportation Projects: If the project involves the use of Federal Highway Administration transportation funds, these recommendations may not fulfill all contract requirements. Please contact the Missouri Department of Transportation at 573-526-4778 or visit <https://www.modot.org/> for additional information on recommendations.

Wright City WWTF



January 25, 2022

- Project Boundary
- Buffered Project Boundary



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Species or Communities of Conservation Concern within the Area:

There are records of state-listed Endangered Species, or Missouri Species or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact the Missouri Department of Conservation for further coordination.

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

Other Special Search Results:

Your project is near a designated Natural Area . Please contact MDC Natural Areas Coordinator, 573-751-4115 for more information.

Project Type Recommendations:

Waste Transfer, Treatment and Disposal -Wastewater treatment plant: New or Maintenance; [Clean Water Act](#) permits issued by other agencies regulate both construction and operation of wastewater systems, and provide many important protections for fish and wildlife resources throughout the project area and at some distance downstream. Fish and wildlife almost always benefit when unnatural pollutants are removed from water, and concerns are minimal if construction is managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any "Clean Water Permit" conditions.

Revegetation of disturbed areas is recommended to minimize erosion, as is restoration with of native plant species compatible with the local landscape and for wildlife needs. Annuals like ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crown vetch and sericea lespedeza.

Management Recommendations for Construction Projects Affecting Missouri Streams and Rivers is a Conservation Department publication available at http://mdc.mo.gov/sites/default/files/resources/2013/02/constprojnearstreams_2013.pdf

Project Location and/or Species Recommendations:

Endangered Species Act Coordination - Indiana bats (*Myotis sodalis*, federal- and state-listed endangered) and Northern long-eared bats (*Myotis septentrionalis*, federal-listed threatened) may occur near the project area. Both of these species of bats hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in wooded areas, often riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats or Northern long-eared bats, especially from September to April. If any trees need to be removed for your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.

Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment. Please inspect and clean equipment thoroughly before moving between project sites. See

<https://mdc.mo.gov/community-conservation/managing-invasive-species-your-community> for more information.

- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (>140° F, typically available at do-it-yourself car wash sites), and dry in the hot sun before using again.

Streams and Wetlands – Clean Water Act Permits: Streams and wetlands in the project area should be protected from activities that degrade habitat conditions. For example, soil erosion, water pollution, placement of fill, dredging, in-stream activities, and riparian corridor removal, can modify or diminish aquatic habitats. Streams and wetlands may be protected under the Clean Water Act and require a permit for any activities that result in fill or other modifications to the site. Conditions provided within the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 permit (<http://www.nwkc.usace.army.mil/Missions/RegulatoryBranch.aspx>) and the Missouri Department of Natural Resources (DNR) issued Clean Water Act Section 401 Water Quality Certification (<http://dnr.mo.gov/env/wpp/401/index.html>), if required, should help minimize impacts to the aquatic organisms and aquatic habitat within the area. Depending on your project type, additional permits may be required by the Missouri Department of Natural Resources, such as permits for stormwater, wastewater treatment facilities, and confined animal feeding operations. Visit <http://dnr.mo.gov/env/wpp/permits/index.html> for more information on DNR permits. Visit both the USACE and DNR for more information on Clean Water Act permitting.

For further coordination with the Missouri Department of Conservation and the U.S. Fish and Wildlife Services, please see the contact information below:

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Miscellaneous Information

FEDERAL Concerns are species/habitats protected under the Federal Endangered Species Act and that have been known near enough to the project site to warrant consideration. For these, project managers must contact the U.S. Fish and Wildlife Service Ecological Services (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132; Fax 573-234-2181) for consultation.

STATE Concerns are species/habitats known to exist near enough to the project site to warrant concern and that are protected under the Wildlife Code of Missouri (RSMo 3 CSR 1 0). "State Endangered Status" is determined by the Missouri Conservation Commission under constitutional authority, with requirements expressed in the Missouri Wildlife Code, rule 3CSR 1 0-4.111. Species tracked by the Natural Heritage Program have a "State Rank" which is a numeric rank of relative rarity. Species tracked by this program and all native Missouri wildlife are protected under rule 3CSR 10-4.110 General Provisions of the Wildlife Code.

See https://mdc.mo.gov/sites/default/files/mo_nature/downloads/2021_SOCC.pdf for a complete list of species and communities of conservation concern. Detailed information about the animals and some plants mentioned may be accessed at https://mdc12.mdc.mo.gov/applications/mofwis/mofwis_search1.aspx. If you would like printed copies of best management practices cited as internet URLs, please contact the Missouri Department of Conservation.

Appendix E: Recommended Effluent Limits for the Proposed New 3.5 Million Gallon per Day Wright City South Wastewater Treatment Facility



MEMORANDUM

DATE: 03/08/2022

TO: Cindy LePage, Chief
Engineering Section

THROUGH: Chris Wieberg, Director *CW*
Water Protection Program

THROUGH: John Hoke, Chief *JH*
Water Pollution Control Branch

THROUGH: Heather Peters, Chief *HP*
Watershed Protection Section

FROM: Mike Kruse, Chief *MK*
Total Maximum Daily Load and Modeling Unit

SUBJECT: Recommended Effluent Limits for the Proposed New 3.5 Million Gallons per Day
Wright City South Wastewater Treatment Facility

The Total Maximum Daily Load (TMDL) and Modeling Unit has estimated the influence of a proposed new 3.5 million gallon per day (MGD) industrial and domestic wastewater treatment facility on water quality in Peruque Creek and Lake St. Louis in Warren and St. Charles counties. The analysis was completed to recommend effluent limits that should minimize the potential for the new facility to cause or contribute to the low dissolved oxygen impairment in Peruque Creek and exceedances of Missouri's lake numeric nutrient criteria in Lake St. Louis. The recommended effluent limits are based on a combination of QUAL2K modeling to address low dissolved oxygen in Peruque Creek and BATHTUB modeling to address lake numeric nutrient criteria in Lake St. Louis. Results of the modeling are presented in Attachment 1. Revisions to the Lake St. Louise BATHTUB model are detailed in Attachment 2. Final effluent limit recommendations are highlighted in Table 2 of Attachment 1.

If you have any questions regarding these analyses, please contact Lisa Rodgers, of my staff, by email at Lisa.Rodgers@dnr.mo.gov or by phone at 522-2552. Thank you.

MK/lrh
Attachment

c: John Rustige, Chief, Wastewater Engineering Unit
Steve Hamm, P.E., Wastewater Engineering Unit



Attachment 1: Results of Modeling and Effluent Limit Recommendations for the Proposed New 3.5 MGD Wright City South Facility

The existing Wright City South wastewater treatment facility (MO-0023191) has a design flow of 0.5 MGD and discharges to Peruque Creek (water body identification (WBID) 218), which is on Missouri's 303(d) list of Impaired Waters due to low dissolved oxygen (DO) and low aquatic macroinvertebrate diversity. The existing Wright City facility is also located approximately 16 miles upstream of Lake St. Louis (WBID 7054), which is listed as impaired due to chlorophyll-a (Chl-a) concentrations that exceed Missouri's numeric nutrient criteria for the Plains lake ecoregion. A new Wright City wastewater treatment facility is currently proposed to be constructed near the existing facility and is currently proposed to treat 3.5 MGD of industrial and domestic wastewater, including wastewater from a sizeable beef processing facility. The locations of the existing Wright City South wastewater treatment facility, the impaired segment of Peruque Creek, and Lake St. Louis are displayed on Figure 1.

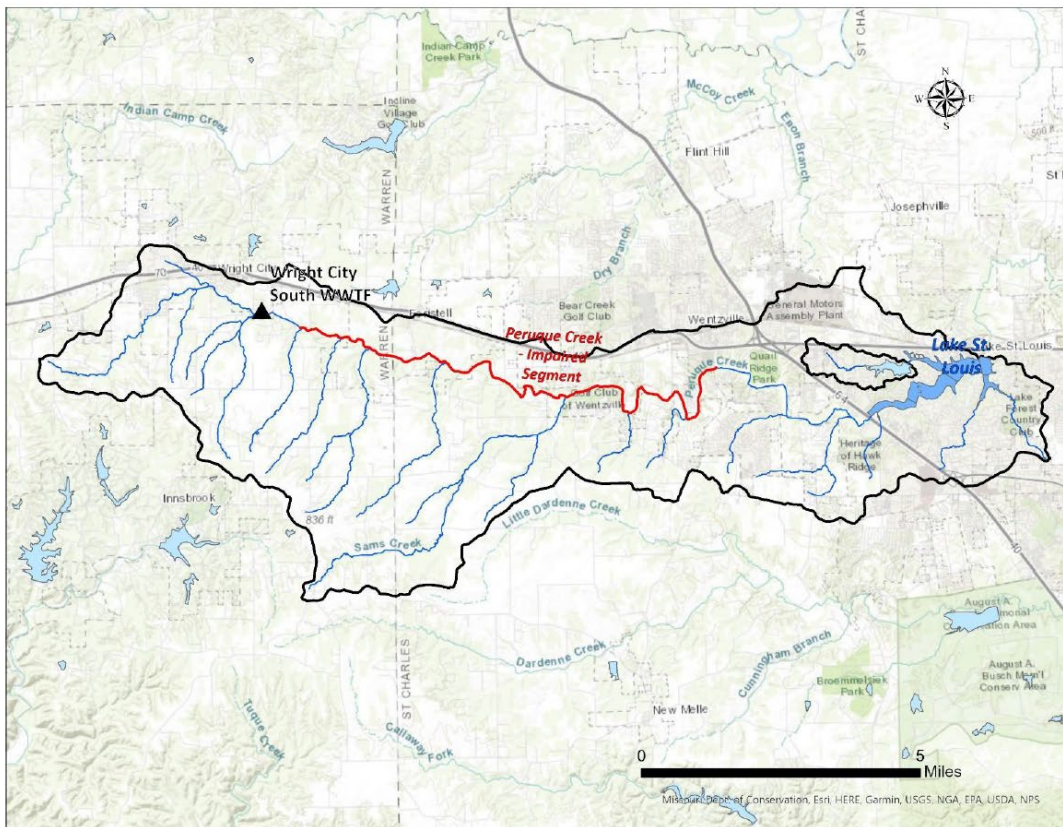


Figure 1. Geographic Scope of Modeling

The TMDL and Modeling Unit had previously conducted a reasonable potential analysis which determined that the existing Wright City South wastewater treatment facility has reasonable potential to contribute to exceedances of Missouri's lake numeric nutrient criteria in Lake St. Louis. As a result, the operating permit issued on October 1, 2020, includes a schedule of compliance for achieving effluent limits for total nitrogen (TN) and total phosphorus (TP) of 11 milligrams per liter (mg/L) and 1 mg/L (respectively) no later than October 1, 2025. Upon receiving a request from the Wastewater Engineering Unit to evaluate the potential influence of a new wastewater treatment facility in the Lake St. Louis watershed, the TMDL and Modeling Unit revised the BATHTUB modeling portion of the reasonable potential analysis for Lake St. Louis to better reflect current procedures and improved understanding of the BATHTUB modeling process.

The revised BATHTUB model was calibrated to 2018 lake data using estimated flow, TN, and TP effluent data from facility discharge monitoring reports submitted between December 2017 and September 2018, and nonpoint source loading estimates from the Spreadsheet Tool for Estimating Pollutant Loads (STEPL).¹ Percent losses of TN and TP over distance (attenuation) estimates were applied to facility discharges in accordance with the methods outlined in the original March 2020 Lake St. Louis reasonable potential analysis memo. The model outputs in Table 1 are based on maximum potential TN and TP discharges estimated from the ammonia as nitrogen and total suspended solids limits in the previously issued Wright City South operating permit (expired March 30, 2020). As shown, Chl-a concentrations increase when the design flows and permit limit-based TN and TP concentrations are entered into the BATHTUB model. These model outputs indicate that the Wright City South wastewater treatment facility has reasonable potential to contribute to exceedances of the Chl-a criterion for Lake St. Louis at the current design flow of 0.5 MGD, an expanded design flow of 1.0 MGD, and the 3.5 MGD design flow currently proposed for a new facility. The magnitude of the Chl-a, TN, and TP concentrations predicted by the model increase incrementally as Wright City South design flows are increased. Based on the results of the Lake St. Louis BATHTUB model, specific effluent limits are needed to minimize the potential for discharges from the Wright City South wastewater facility to contribute to exceedances of the Chl-a criterion, and the TN and TP screening thresholds.

Table 1. BATHTUB-Estimated Numeric Nutrient Outputs with Permit-Based Inputs

Wright City South at TP=9 mg/L, TN=24.4 mg/L	Design Flow (MGD)	Criterion	Screening Thresholds		Secchi (meters)
		Chl-a (µg/L)	TP (µg/L)	TN (µg/L)	
Plains Criteria	NA	30	49	843	NA
Calibration 2018	NA	31	73	731	0.8
All Minor <i>de minimis</i> facilities	0.132	32	75	741	0.8
Wright City South (Existing)	0.5	33	80	783	0.8
Wright City South (Expanded)	1.0	34	86	833	0.7
Wright City South (Proposed New)	3.5	38	106	1023	0.7

¹ TN and TP effluent concentration data were not available. Effluent TN was estimated based on permit limits for ammonia nitrogen plus a default value of 20 milligrams per liter (mg/L) for nitrate/nitrite, and TP was estimated as 30 percent of TSS up to a maximum of 11 mg/L. The STEPL model can be accessed at: <https://www.epa.gov/nps/spreadsheet-tool-estimating-pollutant-loads-step1>.

Since the Wright City South wastewater treatment facility discharges to a DO-impaired segment of Peruque Creek, a QUAL2K model was used to estimate effluent limits that should reduce the potential for wastewater discharges to cause or contribute to low DO in Peruque Creek, as well as minimize the potential for the facility to contribute to Chl-a impairments in Lake St. Louis. The QUAL2K model was developed using flow data recorded on September 24, 2002, combined with stream chemistry data recorded on September 5, 2002. Due to the age of the data, the use of stream chemistry and flow data recorded on different days, and an unusual stream flow pattern at the time flows were recorded, the QUAL2K model does not necessarily represent a typical low-flow condition in Peruque Creek. The model does, however, represent a relatively shallow, low-flow stream, on a fairly flat gradient during a time when water temperatures are warm. Since the QUAL2K model is a generalized representation, minimum DO model outputs near or above 5.5 mg/L are preferred to provide a margin of safety.²

The TMDL and Modeling Unit had previously (August 25, 2021) provided a similar analysis based on a proposal that a new facility would treat only wastewater from beef processing operations, would have a design flow of 2 MGD, and would be located near the Warren-St. Charles county line just west of Foristell. For this current QUAL2K model, the location of the proposed new facility is near the current Wright City South wastewater treatment facility. The location of Wright City South and the quantity of wastewater discharge compared to critical condition (7Q10) flows in Peruque Creek make the facility the “headwater” and primary source of flow in the DO-impaired stream segment.³ As displayed in Table 2, and similar to the BATHTUB modeling, the QUAL2K model scenarios include the existing facility design flow of 0.5 MGD and increases in facility design flows to 1 MGD (expanded) and 3.5 MGD (proposed new). The effluent limits recommended for the Wright City South wastewater treatment facility in Scenario 4 for flows up to 3.5 MGD are the final effluent limits required by the current operating permit and are recommended based on additional BATHTUB modeling. Discussion on the derivation of the final effluent limits using BATHTUB modeling follows Table 2.

Note from Table 2 that lower five-day biochemical oxygen demand (BOD₅) concentrations are required at lower facility flows to achieve DO concentrations close to 5.5 mg/L in Peruque Creek. This is because changes in flow and location greatly influence the model’s calculations due to dilution, reaeration, and attenuation factors. When the model considers those factors, greater facility flows do not necessarily result in the need for lower effluent concentrations. That is why mass loading calculated from model outputs with different locations, flow, or effluent concentrations should not be applied to separate scenarios. Appropriate effluent concentrations can only be determined by entering each unique set of facility characteristics into the models.

² Missouri’s water quality standards establish a minimum DO criterion of 5.0 mg/L in streams for the protection of aquatic life in warm water habitats.

³ Wright City South design flows of 0.5, 1.0, and 3.5 MGD equate to 0.93, 1.86, and 6.50 cubic feet per second (cfs), respectively. The USGS Streamstats 7Q10 low flow estimate for Peruque Creek near Wright City South is 0.005 cfs.

Table 2. QUAL2K Modeling Results for Wright City South on Peruque Creek

Scenario	Facility Flow MGD	Effluent Concentrations in mg/L							Peruque Creek Min. DO
		Facility DO	BOD ₅	TSS	Ammonia as N	Nitrate/Nitrite	TN	TP	
1 Existing Facility	0.5	7.0	3.0	10	0.6	15	15.7	1.0	5.43
2 Expanded Facility	1.0	7.0	5.0	10	0.6	15	15.7	1.0	5.44
3 Proposed New Facility – Peruque Creek WQ	3.5	7.0	6.0	10	0.7	14.3	15.5	1.0	5.58
4 Proposed New Facility – Lake St. Louis WQ	3.5	7.0	6.0	10	0.7	10.0	11.0	1.0	5.61

The QUAL2K-derived effluent concentrations for the proposed new 3.5 MGD wastewater discharge to Peruque Creek (Table 2, Scenario 3) were run through the BATHTUB model for Lake St. Louis. Reducing effluent TN and TP to the concentrations that result in DO model outputs greater than 5.5 mg/L in Peruque Creek reduce the potential for discharges from Wright City South to contribute to Chl-a impairments in Lake St. Louis. However, the resulting in-lake TN concentration still exceeds the calibration value and the screening threshold. Exceedances of screening thresholds can result in eutrophication factors that violate Missouri's lake numeric nutrient criteria.⁴ When the Wright City South effluent limit of 11 mg/L TN was run through the BATHTUB model, TN outputs are below the screening threshold at all facility flows. Therefore, it is recommended that the final TN effluent limit of 11 mg/L in the current Wright City South permit be maintained for the proposed new facility. When the effluent limit of 1 mg/L TP is run through the BATHTUB model, TP remains 30 percent above the screening threshold, but is 2 microgram per liter (µg/L) lower than the calibration model. A recent study of Florida lakes indicates that internal phosphorus loading may account for approximately 30 percent of TP loading in eutrophic lakes.⁵ Phosphorus runoff from the residential areas that surround the lake may also contribute to exceedances of the TP screening threshold.

The QUAL2K and BATHTUB models provide some assurance that enforcing effluent limits of 11 mg/L TN and 1 mg/L TP at the existing and a proposed new Wright City South wastewater treatment facility will protect water quality in Peruque Creek and Lake St. Louis. Those values are maximum concentrations and every effort should be made to achieve effluent concentrations below the maximum allowable concentrations whenever possible.

⁴ Missouri's statewide lake numeric nutrient criteria include ecoregion-based criteria for Chl-a, and screening thresholds for TN and TP. When screening thresholds are exceeded five eutrophication factors are considered when determining the impairment status of lakes. Missouri's Lake Nutrient Criteria Implementation Plan can be accessed at: <https://dnr.mo.gov/document-search/nutrient-criteria-implementation-plan-july-27-2018>.

⁵ "Eutrophic" lakes have an abundant accumulation of nutrients that support dense growth of algae and other organisms, the decays of which depletes the water of oxygen. *Sediment Nutrient Release – It's Not Just for Eutrophic Lakes! Implications for Surface Water Restoration*. Harvey Harper, Environmental Research & Design, Inc. Presented at North American Lake Management Society 2021 Virtual Symposium, November 16, 2021.

The highlighted row in Table 2 (above) shows the estimated resulting DO concentration in Peruque Creek. Tables 3 and 4 show the results of the Lake St. Louis BATHTUB models with effluent TN concentrations of 15.5 mg/L and 11 mg/L (respectively).

Table 3. Wright City South at QUAL2K-Derived Limits

Wright City South at TP=1 mg/L, TN=15.5 mg/L	Design Flow (MGD)	Criterion	Screening Thresholds		Secchi (meters)
		Chl-a (µg/L)	TP (µg/L)	TN (µg/L)	
Plains Criteria	NA	30	49	843	NA
Calibration 2018	NA	31	73	731	0.8
All Minor <i>de minimis</i> facilities	0.132	32	75	741	0.8
Wright City South (Existing)	0.5	31	74	757	0.8
Wright City South (Expanded)	1.0	31	73	784	0.8
Wright City South (Proposed New)	3.5	30	71	892	0.8

Table 4. Wright City South at Final Effluent Limits by October 2025

Wright City South at TP=1 mg/L, TN=11 mg/L	Design Flow (MGD)	Chl-a (µg/L)	Screening Thresholds		Secchi (meters)
			TP (µg/L)	TN (µg/L)	
Plains Criteria	NA	30	49	843	NA
Calibration 2018	NA	31	73	731	0.8
All Minor <i>de minimis</i> facilities	0.132	32	75	741	0.8
Wright City South	0.5	31	74	743	0.8
Wright City South	1.0	31	73	758	0.8
AFG + Wright City South	3.5	30	71	821	0.8

Attachment 2: Revised Lake St. Louis BATHTUB Calibration Model Inputs

Based on the improved procedure for BATHTUB modeling, lake segmentation was corrected, the model was calibrated based on estimated actual facility flows and nutrient discharge, and the area of nonpoint source load contributions to the lake were reduced.⁶ BATHTUB model inputs require that lakes are segmented based on changes in depth, flow direction, and incoming tributaries. It is also useful to establish lake segments based on sample points that capture water quality in areas of the lake other than the assessment point at the lake dam, when available. The revised BATHTUB model increased the number of lake segments from two to six as illustrated in Figure 2. The water quality monitoring point near the Lake St. Louise dam was input as a “monitored inflow” in the original and revised models.

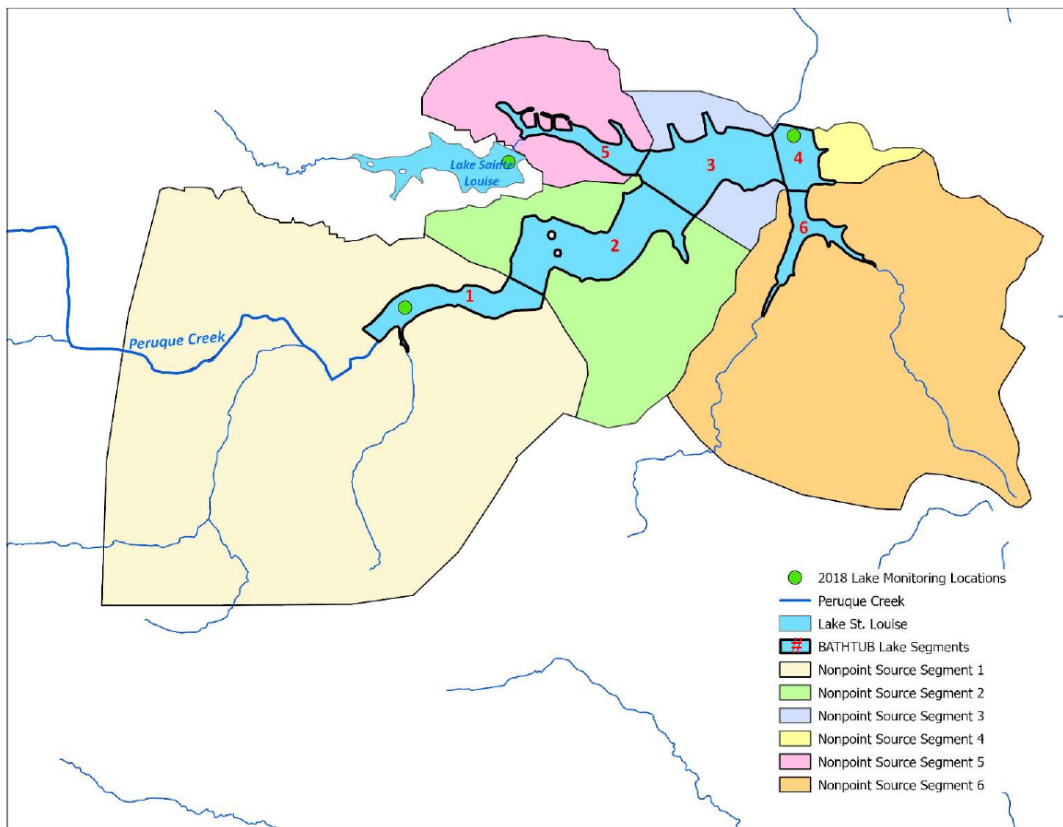


Figure 2. Revised BATHTUB Lake Segmentation and Nonpoint Source Loading Area

⁶ It has recently been clarified that inclusion of too large an area of nonpoint source loading contribution to lakes result in initial BATHTUB nitrogen and phosphorus outputs much greater than those recorded in the lake. Current BATHTUB modeling methods reduce the nonpoint source loading area so that the model outputs are much closer to the recorded water quality prior to refined calibration.

Characteristics of lake segments and nonpoint source areas are displayed in Tables 5 and 6.

Table 5. Characteristics of Lake Segments

Segment	Flows to Segment	WQ Sample ID	Surface Area (km ²)	Mean Depth (meters)	Length (km)	Mixed Layer Depth (meters)
1	2	7054/2.3	0.27	1.0	1.7	1.0
2	3	none	0.58	6.0	1.9	5.0
3	4	none	0.48	6.0	1.2	5.0
4	Out of Lake	7054/0.15	0.16	6.0	0.5	5.0
5	3	none	0.17	1.0	1.3	1.0
6	4	none	0.15	1.0	0.8	1.0

Table 6. Characteristics of Nonpoint Source Loading Areas

Nonpoint Source Load to Lake Segment	Land Use Categories	Land Use Area km ²
1		
	Urban	4.42
	Cropland	0.59
	Pastureland	1.24
	Forest	2.66
	sum	8.91
2		
	Urban	1.73
	Cropland	0.00
	Pastureland	0.00
	Forest	0.16
	sum	1.89
3		
	Urban	0.46
	Cropland	0.00
	Pastureland	0.00
	Forest	0.03
	sum	0.49
4		
	Urban	0.17
	Cropland	0.00
	Pastureland	0.00
	Forest	0.04
	sum	0.21
5		

Nonpoint Source Load to Lake Segment	Land Use Categories	Land Use Area km ²
	Urban	1.06
	Cropland	0.02
	Pastureland	0.04
	Forest	0.10
	sum	1.22
6		
	Urban	4.61
	Cropland	0.07
	Pastureland	0.02
	Forest	0.68
	sum	5.38

The BATHTUB model was calibrated using estimated actual point source flows, TN, and TP contributions as displayed in Table 7.

Table 7. Estimated Actual Point Source Flows, TN, and TP in Calibration Model

Facilities	2017-2018 1-yr Avg Flow GPD	DMR TP mg/L	BATHTUB (%Loss) TP µg/L	DMR TN mg/L	BATHTUB (%Loss) TN µg/L	Distance from Lake (miles)
SCCPWSD#2, Castlegate MHP and Providence	26,605	1.750	300	20.41	5,200	6.3
Foristell Interim WWTP	9,500	1.500	210	20.27	4,360	12.4
Maple Ridge MHP	8,667	0.083	10	23.00	4,640	17.3
SCCPWSD#2, Boone Ridge Estates WWTF	7,848	0.720	140	20.00	5,560	5.8
Stewart MHP WWTF	875	3.300	420	37.78	7,630	17.0
All minor	53,495	Avg.	216	Avg.	5,478	N/A
Wright City South WWTF	400,000	3.421	450	11.30	2,330	15.7
General Motors Wentzville Assembly Cntr	977,792	Avg.	70	Avg.	800	6.6